



Business Process Management of Vehicle Sales and After-Sales Services: A Case Study in an Indonesian Auto Company

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Abstract

Background: XYZ, Inc., a medium-sized automotive company specializing in vehicle sales and repair services, faces significant operational challenges arising from manual processes, fragmented information systems, and limited interdepartmental coordination. These inefficiencies result in extended processing times, reduced data accuracy, and a negative impact on customer satisfaction (CSAT).

Objective: This study aims to analyze and redesign the vehicle sales and repair service processes at XYZ, Inc. using the Case Study framework. BPMN 2.0 was employed to identify bottlenecks, misalignments among sales, repair, and inventory units, and sources of manual data entry inefficiency.

Methods: This research adopts a qualitative descriptive case study design following the five-stage BPM Lifecycle (identification, discovery, analysis, redesign, and implementation). Data were collected through structured interviews, direct observation, and document review. BPMN 2.0 was used to model as-is and to-be processes, and performance gaps were measured by comparing actual versus expected processing times across key activities.

Results: The redesigned processes led to faster processing times, a reduction of errors, and improved data sharing among departments. Post-project assessments showed that BPM enhances customer experience by facilitating faster service delivery and response. Additionally, performance analytics were implemented to track top-level metrics such as cycle time, data quality, and repair response time.

Conclusion: BPM implementation at XYZ, Inc. resulted in significant reductions in processing time for vehicle sales and repair activities, including a reduction in Sales Order Preparation from 18.5 to 9 hours and Parts Ordering from 8 to 2 hours. The redesigned processes improved data accuracy, interdepartmental integration, and overall operational efficiency. These findings demonstrate the practical value of the BPM Lifecycle approach in the automotive retail and service sector.

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INTRODUCTION

The global automotive industry is undergoing rapid transformation driven by digitalization, shifting consumer expectations, and intensified market competition (Llopis-Albert et al., 2021). In this fast-paced and customer-centric environment, efficient business processes are among the most critical enablers of organizational competitiveness (Ahmad & Van Looy, 2020). Automotive companies that rely on manual workflows, siloed information systems, and fragmented interdepartmental coordination frequently experience service delays, data inaccuracies, and diminished customer satisfaction (Bartlett et al., 2023). Studies indicate that up to 40% of operational inefficiencies in automotive dealerships stem from manual data entry errors and a lack of integrated information systems (Felicio, 2021; Saha et al., 2022; Turi, 2024).

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The challenge of digital transformation in the automotive sector is therefore not merely a technical issue but a fundamental business process challenge requiring systematic approaches to process redesign and automation (Butt, 2020). XYZ, Inc. is a medium-sized automotive company operating in the vehicle sales and after-sales services sector, handling an average of 120 vehicle sales transactions and over 300 repair service orders per month.

Prior to Business Process Management implementation, the company recorded a customer complaint rate of approximately 18%, with an average service delivery delay of 3.2 days beyond the committed timeline. Customer satisfaction scores (CSAT) averaged 62 out of 100, well below the industry benchmark of 78 (Beerepoot et al., 2023). These challenges were largely attributable to the company's reliance on manual data entry, lack of integration between sales, repair, and inventory departments, and absence of real-time monitoring mechanisms. This study aims to investigate how Business Process Management (BPM), when systematically applied through its lifecycle framework, can redesign and optimize key operational processes to improve efficiency, data accuracy, and customer service quality (Ahmad & Van Looy, 2020; Bartlett et al., 2023).

Business Process Management (BPM) provides a structured methodology for identifying, analyzing, redesigning, and monitoring business processes to achieve continuous improvement (Dumas et al., 2013; Ubaid & Dweiri, 2020; Zuhaira & Ahmad, 2021). Through techniques such as process automation, system integration, and performance monitoring, BPM enables organizations to eliminate redundant activities, reduce manual intervention, and improve data flow across departments (Adepoju et al., 2022; Gažová et al., 2022; Oliveira et al., 2025). In the automotive sector, BPM has been applied to optimize sales workflows, service scheduling, inventory management, and customer relationship processes, yielding measurable improvements in operational efficiency and service quality (Gómez-Valiente et al., 2023).

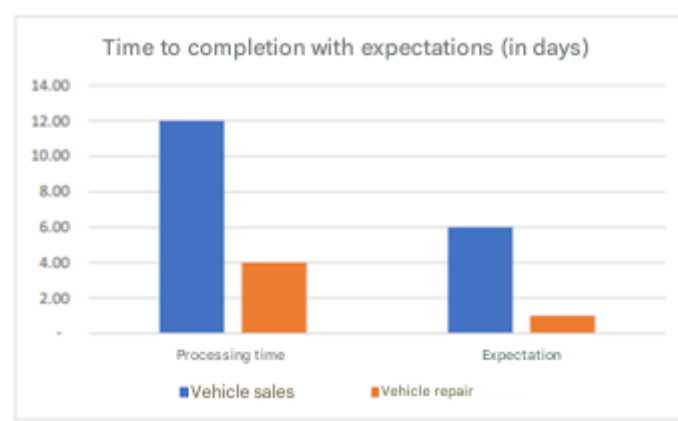


Figure 1. Execution Time v Management Expectations

The next figure compares the actual time taken to execute top business processes (vehicle sales and repairs) in October 2023 versus the expected completion times set by management. Numerous arrows indicate the gaps between actual performance and management expectations (see chart). The time taken to sell vehicles (blue bar) is considerably higher than expected, and the same pattern is observed in repair work (orange bar) (Lizano-Mora et al., 2021). This disparity highlights a lopsided mapping of how BPM principles can be effectively applied to these processes for end-to-end optimization. The objective is to close these gaps more efficiently and align actual performance with organizational expectations (Kim et al., 2022).

Despite the growing body of BPM literature, empirical studies specifically addressing the integration of vehicle sales, repair services, inventory management, and customer satisfaction within a single BPM lifecycle framework remain limited (Harmon, 2010). Most existing research focuses on either sales or service processes in isolation, without examining how their interdependencies contribute to overall operational performance. This study addresses this gap by applying the complete BPM lifecycle—comprising process identification, discovery, analysis, redesign, and implementation—to both the vehicle sales and repair processes at XYZ, Inc.

This study aims to document and analyze the current vehicle sales and repair service processes using BPMN 2.0, identify key obstacles and performance gaps, redesign and implement

optimized processes through automation and system integration, and evaluate the impact of BPM implementation on processing time, data accuracy, and overall operational efficiency. The findings are expected to provide practical insights for automotive dealerships and repair service centers seeking to leverage BPM as a foundation for digital transformation while enhancing the quality of service provided to customers.

METHOD

Design and Research Approach

This study used a qualitative descriptive case study design, integrated into the Business Process Management (BPM) Lifecycle framework (Dumas et al., 2013). The case study approach was chosen because it allowed for an in-depth examination of contemporary phenomena in real contexts, especially when the boundaries between the phenomenon and the context could not be defined decisively (Dumas et al., 2013). The BPM Lifecycle framework served as an analytical foundation, providing a structured and iterative approach that included identifying, analyzing, redesigning, implementing, and monitoring business processes. The research was conducted at XYZ, Inc., an automotive dealership and vehicle repair services company, from October 2023 to March 2024.

Location and Research Object

XYZ, Inc. is an automotive company engaged in vehicle sales and repair services and was selected as the research location. Two main business processes were determined as the objects of the study: 1) Vehicle Sales Process; and 2) Vehicle Service and Repair Process

Data Collection Techniques

This study applied a data triangulation strategy using three data collection techniques simultaneously, as recommended in case study research (Yin, 2018).

1. **Semi-structured interviews:** Interviews were conducted with key stakeholders, including salespeople, service consultants, technicians, inventory staff, and operational supervisors, with an average duration of approximately 60 minutes per informant. The interview guidelines were designed to be open yet focused on specific topics, such as sales workflows, service scheduling, parts management, and identifying barriers and opportunities for process improvement.
2. **Field observations:** Direct observation was carried out in the showroom and workshop areas over several weeks. Documentation included actual process flows, turnaround times for each stage, cross-functional interactions, and identification of bottlenecks and redundant steps that could potentially be eliminated. Continuous observation served to validate the interview findings while capturing routine activities that were not always disclosed by informants.
3. **Document analysis:** The internal documents reviewed included Standard Operating Procedures (SOPs), administrative forms, inventory records, and historical data on actual and target processing times. This secondary data was used to establish an initial quantitative context (baseline) for the measurement of performance indicators.

Data Validation

The validity of the data was ensured through two mechanisms. First, inter-source triangulation, in which the results of interviews and observations were cross-verified with document data from various informants to ensure consistency. Second, member checking, in which every As-Is process model that was built was validated by relevant domain experts to ensure accuracy and completeness.

Research Procedure

This study followed the five stages of the BPM Lifecycle systematically (Dumas et al., 2013):

1. **Process Identification:** The main business processes that were the focus of the study were identified based on Opportunity Gaps (O-Gaps) observed in vehicle sales and service activities.
2. **As-Is Modeling:** Existing process flows were modeled using Business Process Model and

- Notation (BPMN 2.0) in Bizagi Modeler, including mapping actors, documents, and decision points for each workflow.
3. Process Analysis: Actual processing times were compared to targets to identify bottlenecks, error-prone manual tasks, and inefficient process segments.
 4. To-Be Design: Improvements were designed by integrating automation, synchronizing front-office and back-office systems (sales, service, and inventory), standardizing approval flows, and utilizing Customer Relationship Management (CRM) tools to improve customer monitoring.
 5. Implementation and Monitoring: The redesigned process was integrated into the company's ERP system. Performance was monitored using predetermined KPIs, including processing time, error rate, inventory accuracy, and customer satisfaction.

Simulation Parameters and Devices

To measure the quantitative impact of the designed improvements, this study used BPMN-based process simulation (Business Process Simulation). The BPMN model was imported into Bizagi Process Simulator software or the Camunda Platform. Simulation parameters—including average turnaround time, order arrival distribution, and inventory stock levels—were estimated from the company's historical data. Simulation results, in the form of lead time and throughput, were compared between the As-Is and To-Be models to measure the potential for performance improvement. All models and parameters were documented to ensure reproducibility.

Data Analysis Techniques

Data analysis was conducted using a multi-method approach, including: 1) Time analysis to measure the duration of each process stage. 2) Bottleneck analysis to identify segments inhibiting overall flow. 3) Simulation-based analysis to quantitatively evaluate To-Be scenarios. 4) Comparative analysis to measure differences in performance between As-Is and To-Be conditions.

Ethical Considerations

All informants provided written informed consent prior to participation. The identities of companies and individuals were anonymized to maintain confidentiality. The collected data was protected and used solely for research purposes. Ethical approval was obtained from the committee of the authorized institution.

RESULTS AND DISCUSSION

Results

In this paper, we showcase the essential results of this research work and the BPM-focused approach. The processes and results redefine the BPM life cycle with improved processing time, accuracy, and efficacy. The main results of the study are summarized below, with tables and charts illustrating the qualitative improvements ([Lopes & Guerreiro, 2023](#)).

Process Identification and Discovery

Process identification and process discovery are the first steps in the BPM lifecycle. At this stage, the current processes were mapped for car sales and repairs to comprehend the existing workflow and identify inefficiencies. We introduced process maps and workflow diagrams using BPMN (Business Process Model and Notation) at XYZ, Inc.

It was observed that in processes such as vehicle sales and repairs, significant time lags occurred due to manual data entry, lack of interoperability between departments, and poor task assignment.

Process Analysis

The next step in the BPM lifecycle is process analysis. This stage identifies bottlenecks and weaknesses in the workflow. Expected processing times were carefully compared against the actual duration of tasks ([Teixeira et al., 2024](#)).

The analysis revealed that the time required for vehicle sales and repair processes exceeded management expectations. This inefficiency resulted from the following factors: 1)

Errors requiring rework due to manual data entry. 2) isconnection between sales, repair, and inventory departments. 3) Backlogs in scheduling vehicle preparation and servicing. Table 1 presents a comparison of the expected processing times versus actual times for key activities in the vehicle sales and repair processes.

Table 1. PROS Time on vehicle sales process vs management expectations

Process	Actual Time (in hours)	Expected Time (in hours)
Customer Lead Management	1.75	0.5
Test Drive	3.5	1.25
Negotiation	3	0.5
Sales Order Preparation	18.5	9.75
Vehicle Order to OEM	14.5	8.75
Financing and Settlement	30	17
Vehicle Preparation	12.75	3.75
Warranty Registration	2	0.25
Vehicle Delivery	12	10
Post-Sale Survey	6	0.25

Sale Order Preparation phase, in particular, was found to last almost twice the expected time, as indicated in Table 1. This delay is attributed to various manual tasks in document verification and approvals from different departments [15]. Table 2 compares the actual processing times with management's expected times for key tasks in the repair process:

Table 2. Time Spent on Vehicle Repair Process vs. Management Expectations

Process	Actual Time (in hours)	Expected Time (in hours)
Reservation for Service	1.5	0.25
Vehicle Diagnosis	1.5	0.25
Work Order Creation	4.25	2.75
Parts Ordering	8	0.5
Insurance Claim Handling	3	0.5
Warranty Claim Handling	5	1
Invoice and Payment	1	0.75
Post-Service Survey	6	1

As summarized in Table 2, the Parts Ordering process within the repair workflow took much longer than anticipated due to delays in receiving parts and frequent inventory mismanagement arising from manual tracking systems.

Process Redesign

The process redesign phase presented several challenges. To address these, we introduced automated solutions and established smooth workflows to ensure zero delays and eliminate bottlenecks. By completely redesigning the processes across the following areas:

- Sales Process Automation:** An end-to-end integrated software system was implemented to automate the customer lead handling process, including availability checks and order processing.
- Repair Process Integration:** A unified solution was deployed to automate work order creation, parts ordering, and technician assignment. This integration prevented delays and errors in departmental updates, as data began to be updated automatically.
- Customer Relationship Management (CRM):** CRM was used to differentiate customers, monitor engagement, and provide timely follow-ups for both sales and repair activities.

These processes, redefined through automation, have been effectively operationalized, particularly in crucial business areas such as Sales Order Preparation, Parts Ordering, and their respective outputs. When integrated via Electronic Data Interchanges (EDI) into a seamless inventory management ecosystem, processing times were significantly reduced.

Process Implementation

The next step involved the implementation phase, where the redesigned processes were introduced company-wide. The main activities during this phase included:

- a. Staff Training: All employees, including sales agents and technicians, were trained to use the new systems and adhere to the redesigned workflows.
- b. System Integration: The new sales and repair process systems were integrated with existing ERP and inventory management systems.

As shown in Table 3, the comparison of pre- and post-implementation processing times clearly indicates that after implementation, the processing times for Sales Order Preparation (SOP) and Parts Ordering (PO) decreased significantly.

Table 3. Processing Times Before and After BPM

Process	Pre-Implementation Time (in hours)	Post-Implementation Time (in hours)
Customer Lead Management	1.75	0.5
Test Drive	3.5	1.25
Negotiation	3	0.5
Sales Order Preparation	18.5	9
Vehicle Order to OEM	14.5	8
Financing and Settlement	30	17
Vehicle Preparation	12.75	3.75
Warranty Registration	2	0.25
Vehicle Delivery	12	10
Post-Sale Survey	6	0.25

Table 3 shows a considerable reduction in the time required for the post-implementation process on tasks integral to the sales workflow, such as Sales Order Preparation and Vehicle Order to OEM. This improvement significantly enhanced the efficiency of the entire sales process and contributed to a better customer experience.

Table 4. Key Performance Indicators (KPIs) Before and After BPM Implementation

KPI	Pre-Implementation	Post-Implementation	Improvement
Avg. Sales Cycle Time (hours)	104.5	58.5	↓44%
Avg. Repair Turnaround Time (hours)	30.25	13.5	↓55%
Manual Data Entry Error Rate (%)	23%	6%	↓74%
Inventory Accuracy (%)	71%	94%	↑32%
Repair Response Time (hours)	4.5	1.2	↓73%

Process Monitoring

Process monitoring is the final step in the process lifecycle. During this phase, redesigned processes were systematically measured to ensure that the results aligned with expectations. Over several months, metrics such as processing time, error rates, and customer satisfaction levels were monitored using key performance indicators (KPIs).

The results were continuously tracked to demonstrate that process improvements were sustained over time. Sales cycle time, repair turnaround time, and customer feedback consistently improved. Additionally, automation reduced manual work and enhanced data accuracy, leading to decreased operational costs.

Discussion

Control Design

This section introduces the control design stage, which determines how controls will be embedded into the redesigned vehicle sales and repair processes at XYZ, Inc. Control design is

critical to ensure that business process changes are properly implemented initially and maintained over time as part of Business Process Management. The main goal of this step is to verify that optimized processes function correctly, meet high-quality standards, and satisfy both organizational and customer requirements.

Control Objectives

The specific control objectives for the redesigned processes at XYZ, Inc. include:

- a. Ensuring Consistent Performance – Implementing tracking systems to ensure that vehicle sales and repair processes consistently meet performance targets.
- b. Reducing Variability – Establishing systems and procedures to minimize variation in process time, errors, and workflow discrepancies.
- c. Ensuring Accurate Data Flow – Maintaining real-time data flow between departments so that information regarding vehicle sales, repairs, or inventory is always up-to-date.

Control Measures in Vehicle Sales

To streamline the customer journey, XYZ, Inc. fundamentally redesigned its vehicle sales model. Key controls included automated sales order generation, which reduced manual data entry and errors by automatically verifying vehicle availability and generating orders upon user selection. An approval workflow was also added to automatically route sales orders to relevant managers for rapid approvals, eliminating bottlenecks caused by manual interventions. Finally, an integrated sales system with vehicle inventory management was implemented, allowing agents to access accurate vehicle availability records at any time.

Control Measures in Vehicle Repair

The vehicle repair process was redesigned to improve efficiency and accuracy, with key controls implemented as follows:

- a. Work Order Automation – Work orders are automatically generated upon service requests, and technicians are assigned based on availability, reducing delays associated with manual assignment.
- b. Parts Ordering Integration – Parts ordering was automated so that required parts are requested automatically through the system, with notifications about stock availability. This reduces delays due to out-of-stock items and minimizes human error in inventory tracking.
- c. Technician Scheduling – Repair jobs are assigned based on technician availability and task complexity, improving workload distribution and reducing downtime.

Performance Monitoring and Feedback

Performance monitoring was incorporated into the control design to ensure that redesigned processes functioned as intended. This monitoring involves real-time and periodic reviews of KPIs such as:

- a. Sales Order Processing Time – Duration from initial customer inquiry to completed sales order.
- b. Repair Completion Time – Time from vehicle intake for service to delivery.
- c. Inventory Accuracy – Accuracy of vehicle and parts availability data.
- d. Customer Satisfaction – Post-purchase and post-service feedback.

These KPIs are tracked using the newly implemented Business Process Management software, providing dashboards and automated alerts when performance deviates from established targets.

Continuous Improvement and Adaptation

Continuous improvement is a core principle of BPM. Control measures are most effective when systematically adapted and optimized. XYZ, Inc. collects employee and customer feedback through surveys and periodic internal reports to identify areas for improvement. If customers report long delivery times or technicians encounter frequent parts shortages, control measures and workflows are adjusted accordingly.

Conclusion of Control Design

In the control design phase, XYZ, Inc. established systems that ensure the smooth and efficient operation of redesigned vehicle sales and repair processes. Automation of critical processes, integration of all systems, and comprehensive performance monitoring have yielded significant efficiency gains. Moreover, a repetitive feedback loop ensures continuous evolution and enhancement of process performance as the company grows.

CONCLUSION

This study applied the BPM Lifecycle framework to analyze and redesign the vehicle sales and repair service processes at XYZ, Inc., with the objective of identifying key operational bottlenecks, redesigning core workflows through automation and system integration, and evaluating the resulting performance improvements. The findings demonstrate significant reductions in processing time across both process domains: Sales Order Preparation decreased from 18.5 to 9 hours, Vehicle Order to OEM from 14.5 to 8 hours, and Parts Ordering from 8 to 2 hours. Error rates attributable to manual data entry declined, inventory accuracy improved through real-time system integration, and interdepartmental data flow became more consistent and reliable. From a practical standpoint, Business Process Management implementation contributed to improved data integration across the sales, repair, and inventory functions, with the introduction of automated work order generation, real-time technician scheduling, and CRM-linked customer tracking establishing a more coherent and responsive operational infrastructure. These improvements support better decision-making by providing managers with timely and accurate data on process performance. It should be noted, however, that while anecdotal evidence from post-implementation feedback suggests improved customer experience, no formal customer satisfaction (CSAT) survey data were collected; therefore, claims regarding customer satisfaction improvement must be treated as preliminary and require validation through further quantitative research.

This study has several limitations that should be acknowledged. First, the research is based on a single case company (XYZ, Inc.), which may limit the generalizability of the findings to other automotive contexts. Second, the absence of formal CSAT measurement instruments restricts the scope of customer-related conclusions. Third, the long-term sustainability of the implemented changes has not yet been evaluated. For future research, it is recommended to extend the BPM lifecycle study to include post-implementation monitoring over a minimum of 12 months, incorporate validated customer satisfaction measurement instruments, and conduct comparative studies across multiple automotive companies to identify industry-wide best practices in BPM-driven digital transformation.

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AUTHOR CONTRIBUTION STATEMENT

Billie Enceil contributed to the research concept, methodology, case study implementation, and drafting of the manuscript. Gunawan Wang was involved in supervising the research, developing the methodology, and providing academic editing and validation of the manuscript. Both authors reviewed and approved the final version of the manuscript.

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