

Enhancing Operational Efficiency in Bus Companies Through Effective ERP Implementation

Haniyah^{*1}, Daffa Zuhdi Syhada², Muhammad Ainul Yaqin³

^{1,2,3} Universitas Islam Negeri Maulana Malik Ibrahim, Jalan Gajayana 50, Malang,
Indonesia

¹1220605110048@student.uin-malang.ac.id, ²1220605110053@student.uin-malang.ac.id,
³yaqinov@ti.uin-malang.ac.id

*Corresponding Author

Abstract

This study examines the impact of Enterprise Resource Planning (ERP) systems on operational efficiency in bus companies, focusing on production planning and fleet management. The research addresses challenges such as inefficient resource allocation and delayed responsiveness to market demands, which are critical issues in the competitive transportation sector. A quantitative research approach was adopted, utilizing a case study of a bus company implementing an ERP system. Data were collected from ERP modules, including production planning, inventory management, and fleet maintenance. Statistical analyses were conducted to evaluate the effect of ERP on key performance indicators, such as inventory efficiency, schedule adherence, and operational cost reduction. The results demonstrate that ERP implementation significantly improves operational efficiency, enabling real-time adjustments to dynamic market conditions and enhancing customer satisfaction. However, the study also highlights challenges such as reliance on accurate data input and the need for continuous system maintenance to sustain effectiveness. In conclusion, ERP systems are highlighted as vital strategic tools for bus companies seeking to enhance operational efficiency and adaptability. Future research should investigate effective ERP implementation strategies and the long-term impact on organizational performance.

Keywords : Enterprise Resource Planning (ERP), Operational Efficiency, Fleet Management, Bus Company.

INTRODUCTION

In the current era of rapid digitalization and globalization, companies across various sectors are confronted with the pressing need to operate more efficiently, integrate their processes, and respond adeptly to increasingly complex market dynamics. One prominent approach to tackle these challenges is the implementation of Enterprise Resource Planning (ERP) systems. ERP refers to an integrated management framework that automates and manages core business processes, encompassing production, distribution, human resource management, finance, and inventory. By deploying ERP systems, organizations can obtain a holistic and real-time view of all operational activities, thereby supporting swift and precise decision-making based on reliable data [1].

The relevance of ERP adoption is accentuated by the global imperative to enhance corporate competitiveness and productivity. In the transportation sector, particularly within bus companies, efficient operational management is critical to ensuring business continuity. These companies depend heavily on effective fleet management, timely maintenance scheduling, efficient driver allocation, and precise route planning [2]. In the absence of structured management practices, bus companies may face significant operational inefficiencies, such as excessive fleet idle time, delays in service delivery, and escalated maintenance costs resulting from inadequate preventive maintenance.

A key challenge confronting bus companies is the necessity to enhance operational efficiency via an integrated system that can effectively coordinate diverse business functions. ERP systems are posited as crucial solutions to this challenge, enabling bus companies to improve production planning, optimize fleet utilization, and streamline human resource management. Furthermore, ERP systems facilitate enhanced data integration across departments, empowering companies to respond more adeptly to evolving market conditions and passenger demands.

Nevertheless, the implementation of ERP systems in bus companies is fraught with challenges. One notable obstacle is the substantial cost associated with system implementation, which requires a significant initial investment. Additionally, organizations often grapple with shifts in corporate culture, particularly regarding the adaptation of employees to new technologies. Comprehensive training is necessary for employees to leverage the full benefits of ERP, demanding strong commitment from top management [3]. Beyond costs and training, the impact of ERP on human resource management is significant, especially concerning shift scheduling, payroll processing, and driver competency management, which must align with the new technological framework.

Despite these challenges, successful ERP implementation can yield transformative results in operational efficiency. ERP minimizes human errors in fleet planning and management, enhances the accuracy of demand forecasting, and reduces operational costs through improved resource optimization. Moreover, ERP accelerates strategic decision-making processes based on data insights, enabling companies to respond swiftly to fluctuations in market demand.

This study aims to conduct an in-depth analysis of how the implementation of ERP can enhance operational efficiency, particularly in production planning within bus companies. Additionally, the research will explore the effects of ERP implementation on human resource management and the challenges faced during the implementation process. The findings are expected to offer comprehensive solutions to navigate these challenges, facilitating optimal ERP implementation and maximizing its benefits for bus companies.

METHODS

A. RESEARCH APPROACH

This study employs a quantitative approach utilizing a case study method to analyze the relationship between ERP implementation and the enhancement of operational efficiency in bus companies. The quantitative approach was selected to facilitate the analysis of this relationship based on numerical data. Data were collected from the ERP modules, specifically focusing on production planning, inventory management, and fleet maintenance. The quantitative data analysis results were used to evaluate the impact of ERP on key performance indicators, including operational cost efficiency, punctuality of departure schedules, and effectiveness in inventory management.

B. RESEARCH CONTEXT

The research was conducted at a bus company that has implemented an ERP system for over six months. The study took place over a period of three months, from January to March 2024, to ensure an adequate exposure time for observing the effects of ERP on operational efficiency.

C. RESEARCH OBJECT

The primary object of this research consists of operational data extracted from the ERP system of the selected bus company. The criteria for selecting this research object include:

1. **Operational Complexity:** The company operates a fleet of over 17 buses, providing a diverse dataset concerning production planning, inventory management, and fleet maintenance.
2. **ERP Implementation Duration:** The ERP system has been actively utilized for a minimum of six months, ensuring that relevant historical data is available for analysis.
3. **Data Availability:** The company provides comprehensive operational data through integrated reports from the ERP modules, including reports on operational efficiency, inventory levels, and maintenance schedules.

D. DATA COLLECTION METHOD

Data collection involved a detailed examination of ERP-related documents and files provided by the company. The quantitative data gathered comprised:

ERP Data:

- a. **Production Planning:** This includes information on production capacity, travel demand, and scheduled departures.
- b. **Inventory Management:** Data related to spare part stocks, utilization rates, and inventory control practices.
- c. **Fleet Maintenance:** Records on maintenance schedules, vehicle damage history, and frequency of maintenance activities.

E. DATA ANALYSIS

Data analysis was conducted using both descriptive and inferential statistical methods to evaluate the correlation between ERP implementation and operational efficiency. The stages of analysis included:
Data Exploration: The ERP data was systematically organized by module to discern patterns related to operational efficiency.

1. **Statistical Calculation:**
 - a. **Comparative Analysis:** Analyzing efficiency metrics before and after ERP implementation, focusing on reduced operational costs and improved schedule accuracy.
 - b. **Regression or Correlation Analysis:** Utilizing statistical techniques to ascertain the relationship between variables associated with ERP implementation and operational efficiency.
2. **Interpretation of Results:** Findings were presented through tables and narratives, offering a detailed understanding of the influence of ERP on operational efficiency.

F. VALIDITY AND RELIABILITY

To ensure the validity and reliability of the results, the following strategies were implemented:

- a. **Data Triangulation:** Verification of data consistency by comparing information across various ERP modules.
- b. **Audit Trail:** Comprehensive documentation of all stages of data collection and analysis to uphold the transparency of the research process.
- c. **Statistical Validation:** Application of statistical tests (such as t-tests or ANOVA) to determine the significance of the research findings.

This methodology is designed to provide a comprehensive and robust understanding of the quantitative impact of ERP on the operational efficiency of bus companies.

RESULTS AND DISCUSSION

A. DATA PRESENTATION FROM ERP

In this study, the data obtained from the ERP system of a bus company serves as the basis for analyzing operational efficiency in trip planning and management. This dataset captures detailed information on trip reservations, departure schedules, operational requirements, and personnel allocation. By leveraging integrated data, the company can optimize vehicle allocation, coordinate operational schedules, and manage human resources more effectively to meet customer demand.

The fleet data comprises several key elements, including vehicle number, vehicle type, passenger capacity, operational costs, and current vehicle status. This information is critical for selecting the appropriate vehicle for each route, particularly in balancing passenger capacity with minimizing operational costs.

Table 1 presents the fleet data, showcasing various vehicle types and their corresponding operational metrics, such as costs and capacities. This comparative analysis allows for a clear understanding of how each vehicle type performs relative to the company's operational needs. For instance, vehicles with higher passenger capacities may incur increased operational costs; however, their ability to accommodate more passengers can lead to enhanced cost efficiency, particularly on high-demand routes.

Moreover, the ERP system facilitates the centralized collection and regular updating of this fleet data, ensuring the accuracy and reliability of the information. This accuracy is vital for effective operational planning and decision-making. By maintaining precise and up-to-date data, the company can quickly adjust to fluctuations in demand, optimize service delivery, and ultimately improve overall operational efficiency.

Table 1. Order

OrderID	Cust ID	Cust Name	BusID	JadwalID	Type	Status	Harga
ORD001	CUST001	PT Jaya Indah	BUS001	JAD001	Sleeper	Pending	Rp 1.500.000,00
ORD002	CUST002	PT Makmur Terang	BUS002	JAD002	Reguler	Confirmed	Rp 25.000.000,00
ORD003	CUST003	PT Sentosa Baru	BUS003	JAD003	Reguler	Pending	Rp 10.000.000,00
ORD004	CUST004	PT Abadi Mandiri	BUS004	JAD004	Sleeper	Confirmed	Rp 20.000.000,00
ORD005	CUST005	PT Berkah Utama	BUS005	JAD005	Reguler	Confirmed	Rp 5.000.000,00
ORD006	CUST006	PT Sinar Gemilang	BUS006	JAD006	Sleeper	Confirmed	Rp 12.000.000,00
ORD007	CUST007	PT Sejahtera Perkasa	BUS007	JAD007	Reguler	Confirmed	Rp 17.000.000,00
ORD008	CUST008	PT Cahaya Mulia	BUS008	JAD008	Reguler	Confirmed	Rp 15.000.000,00

The data from the Booking Order section, as detailed in Table 1 on the Order, indicates the current status of travel bookings, categorized into Confirmed and Pending statuses. Out of the 8 bookings recorded, 6 have been confirmed, amounting to a total value of IDR 94,000,000. Meanwhile, the remaining 2 bookings are in a Pending status, with a total value of IDR 11,500,000. This indicates that the majority of bookings have been successfully processed, while unfinished orders are likely a result of operational constraints such as fleet limitations or technical issues.

Additionally, the data highlights the popularity of the Regular Bus service, which accounts for 5 bookings with a total value of IDR 71,000,000. In comparison, the Sleeper Bus service has 3 bookings, totaling IDR 33,500,000. Despite the company's primary focus on the Regular service, the Sleeper service demonstrates significant potential for increasing revenue through tapping into the premium market segment.

Table 2. Departure Schedule

Id	day + time of departure	of idBus	Rute	Activity	Day+Time Completed
JBA001	1/10/2024 + 06.00	PAR001	Malang - Jakarta	Deliver	1/10/2024 + 22.00
JBA002	1/10/2024 + 22.00	PAR002	Malang - Bali	Deliver	2/10/2024 + 08.00
JBA003	1/10/2024 + 06.00	PAR003	Malang - Bogor	Deliver	1/10/2024 + 23.30
JBA004	1/10/2024 + 09.00	PAR004	Malang - Yogyakarta	Deliver	1/10/2024 + 15.00
JBA005	1/10/2024 + 14.00	PAR005	Malang - Palembang	Deliver	2/10/2024 + 23.00
JBA006	1/10/2024 + 06.00	PAR006	Jakarta - Malang	Deliver	1/10/2024 + 23.00
JBA007	1/10/2024 + 17.00	PAR007	Bali - Malang	Deliver	2/10/2024 + 03.00
JBA008	1/10/2024 + 06.00	PAR008	Bogor - Malang	Deliver	2/10/2024 + 01.00

The Departure Schedule, as illustrated in Table 2, demonstrates how the ERP system facilitates the organized management of departure times and travel routes. Each bus is assigned a clear departure schedule and specific routes, such as the Malang-Jakarta route departing at 06:00 and the Malang-Bali route at 22:00. The predominance of morning departures for long-distance routes is strategic, as it optimizes travel time and reduces the risk of delays.

The ERP system contributes significantly by ensuring that the fleet allocated for these long journeys is in optimal operational condition and meets the specific needs of each route. Furthermore, this system plays a crucial role in preventing schedule conflicts between different fleets, thereby ensuring smooth and efficient operations.

B. OPERATIONAL EFFICIENCY AND FLEET MAINTENANCE

Table 3. Bus

Code	Parent Item	destination city	destination	number of seats
PAR001	TOP Trans Big (2-3)	Bandung	Braga Kawah Putih Ciwidey Gedung Sate Floating Market Tangkuban Perahu Candi Prambanan Jl. Malioboro	45
PAR002	TOP Trans Medium (2-2)	Jogja	Pasar Beringharjo Benteng Vredeburg Lava Tour Merapi Kawah Ijen Taman Baluran	40
PAR003	TOP Trans Big (2-3)	Banyuwangi	Taman Blambangan Pantai Pulau Merah Dialog Banyuwangi GWK	45
PAR004	TOP Trans Medium (2-2)	Bali	Tegalalang Rice Terrace Pura Penataran Agung Tanah Lot GWK	40
PAR005	TOP Trans Medium (2-2)	Bali	Tegalalang Rice Terrace Pura Penataran Agung Tanah Lot	45

As referenced in Table 3, the implementation of the ERP system has markedly enhanced the operational efficiency of the bus company, especially in fleet management and vehicle maintenance. The integrated ERP system enables real-time monitoring of the fleet's condition, covering aspects such as maintenance status, fuel

consumption, and vehicle equipment. This comprehensive data allows the company to make faster and more informed decisions about fleet management, thereby optimizing the utilization of available resources.

A significant benefit of the ERP system is its ability to decrease fleet downtime, which poses a major challenge to bus company operations. By ensuring that preventive maintenance is performed as scheduled, the system helps avert unexpected breakdowns that could disrupt operations. With more organized maintenance procedures, the company not only lowers unplanned repair costs but also prolongs the vehicles' lifespan, improves fleet reliability, and ensures that buses are consistently ready to meet travel demands.

Table 4. inventory

Code	diesel	E-Toll Balance	cash	Passenger Snacks	Blan ket	Pill ow
PAR001	200	Rp1.000.000	Rp500.000	40	40	40
PAR002	150	Rp200.000	Rp500.000	32	32	32
PAR003	180	Rp200.000	Rp500.000	35	35	35
PAR004	160	Rp1.000.000	Rp500.000	28	28	28
PAR005	220	Rp200.000	Rp500.000	50	50	50

Referring to Table 4, which details the inventory management process, the ERP system enables more efficient management of vehicle equipment, including spare parts like tires, batteries, and filters. Data integration allows the company to closely monitor spare part inventories and make orders only when necessary, effectively reducing storage costs and preventing excess stock accumulation.

This efficient management approach not only enhances fleet performance but also aids in managing operating costs more effectively, supporting long-term profitability. The implementation of ERP in fleet management and vehicle maintenance significantly boosts operational efficiency and enhances the service quality offered to customers. A well-maintained, always-ready fleet improves customer satisfaction by ensuring reliable and timely service.

C. WORKFORCE MANAGEMENT AND DECISION-MAKING

Table 5 highlights the role of ERP in improving workforce management, specifically for bus crew members such as drivers, co-drivers, and assistants. ERP facilitates efficient scheduling by preventing workforce shortages or overlapping assignments on each trip. Through an integrated system, information regarding work schedules, shifts, and crew availability is efficiently managed, ensuring smooth operations without workforce-related disruptions.

The ERP system also enhances data-driven decision-making by providing centralized and easily accessible information. This setup empowers operational managers to make quicker, more accurate decisions. With direct access to comprehensive operational data—including fleet status, vehicle conditions, travel schedules, and workforce needs—managers can effectively assess and respond to changes in operational conditions. For example, in the event of sudden demand surges or essential schedule changes, the company can promptly add fleet units or adjust travel itineraries with minimal delay.

Moreover, the ERP system streamlines managerial processes by reducing reliance on time-consuming manual decision-making. This structured approach makes decision-making more transparent and efficient, thereby minimizing errors and enhancing operational reliability. Such capabilities allow the company to adapt more swiftly to dynamic market shifts and external factors, ultimately supporting the company's growth and long-term sustainability.

Table 5. bus crew

Code	Employee ID	Employee Name	Position	Status
PAR001	SOP011	Edi Sutrisno	Driver	Work
PAR001	WSOP011	Joni Susanto	Deputy Driver	Work
PAR001	KER011	Joko Widodo	Kernet	Work
PAR002	SOP012	Heri Setiawan	Driver	Work
PAR002	WSOP012	Aldi Mahendra	Deputy Driver	Work
PAR002	KER012	Nia Ramadhani	Kernet	Work

D. OPERATIONAL NEEDS AND PASSENGER MEALS

Table 6 details the logistical and operational aspects concerning passenger meals, which play a vital role in enhancing passenger comfort during long trips. Offering meals such as Grilled Chicken with Rice and Orange Juice contributes positively to the travel experience. The company manages meal expenses efficiently, with each portion costing approximately IDR 70,000~75,000.

The ERP system assists by monitoring the number of meal portions needed for each trip, thereby minimizing wastage and preventing shortages. This data is invaluable for assessing passenger preferences, allowing the company to refine and enhance meal service quality in the future.

The tables provided in the article, including Table 6, demonstrate how ERP supports the comprehensive management of the bus company's operations. From managing bookings and fleet allocation to addressing operational needs like passenger meals, ERP provides integrated information that enhances efficiency and informs better decision-making. This level of data integration enables the company to swiftly respond to customer demands, reduce operational disruptions, and ultimately boost customer satisfaction.

Table 6. operational

Code	Route	Food provided	Portion	Meal Cost per portion
PAR001	Malang - Jakarta	Rice, Grilled Chicken, Orange Juice	40	75,000
PAR001	Malang - Jakarta	Rice, Satay, Sweet Iced Tea	45	70,000
PAR001	Malang - Bali	Rice, Grilled Fish, Mineral Water	45	75,000
PAR002	Malang - Bogor	Rice, Soto, Mineral Water	40	70,000
PAR002	Malang - Yogyakarta	Rice, Fried Chicken, Iced Tea	45	75,000
PAR002	Malang - Palembang	Betutu chicken, sempol, rice	50	70,000

E. OPERATIONAL NEEDS AND PASSENGER MEALS

The analysis derived from the ERP system data of the bus company indicates that ERP implementation yields notable benefits in operational management, particularly across areas such as trip booking, fleet allocation, workforce management, and addressing operational needs. As reflected in Table 7, "Total Expenditure," the ERP system's integration enhances efficiency and cost-effectiveness throughout the company's operations.

Table 7. total expenditure

Route	Total
Malang - Jakarta	Rp 7.880.000
Malang - Bali	Rp 6.694.000
Malang - Bogor	Rp 7.542.000
Malang - Yogyakarta	Rp 4.986.000
Malang - Palembang	Rp 6.465.000

The implementation of the ERP system in the bus company facilitates more efficient operational management by integrating booking data, operational needs, workforce, and passenger amenities. The analysis, as detailed in Table 7, "Total Expenditure," reveals that longer routes, such as Malang–Palembang, require greater allocations of fuel, e-Toll balance, cash, and passenger facilities, including meals, blankets, and pillows. In contrast, shorter routes like Malang–Bali necessitate fewer resources.

The ERP system ensures that fleet and resource allocation are aligned with the specific requirements of each route, contributing to more effective operational cost management. Revenue analysis from each route indicates significant variations; for instance, the Malang–Jakarta route generates the highest revenue at IDR 7,880,000, while the Malang–Yogyakarta route accounts for the lowest revenue at IDR 4,986,000.

This data provides valuable insights for developing strategies that optimize fleet capacity and enhance services, such as introducing premium offerings with Sleeper Bus services. Overall, the ERP system empowers the company to plan and manage services more accurately and efficiently, ultimately enhancing customer satisfaction and boosting overall profitability.

F. ANALYSIS OF BOOKINGS AND OPERATIONAL EFFICIENCY

The analysis presented in the Order Booking Table indicates that the majority of bookings, representing 75% of total orders, have been confirmed. This outcome reflects the company's effectiveness in managing most of its bookings. However, the 25% of bookings that remain in a pending status suggest potential challenges, such as limited fleet availability or technical issues. These challenges could impede operational efficiency and should be promptly addressed to improve service quality.

The ERP system significantly contributes to streamlining booking management by providing an integrated platform that allows for real-time status updates. This capability enables the company to respond swiftly to customer demands and optimize fleet allocation. Nevertheless, the operational challenges highlighted by the pending orders point to the necessity for enhanced management of fleet inventory and scheduling practices. Addressing these issues will be essential for the company to maintain high service standards and operational efficiency.

G. OPTIMIZATION OF DEPARTURE SCHEDULES

The Departure Schedule Table demonstrates how the ERP system facilitates organized scheduling and effective route planning, enabling the company to optimize travel times and avoid scheduling conflicts. For instance, the implementation of early morning departures for long-distance routes, such as Malang–Jakarta, exemplifies time-efficient practices.

This capability indicates that the ERP system allows the company to respond flexibly to operational dynamics. However, the analysis also identifies opportunities for improvement, such as leveraging historical data to design schedules that align with demand trends. For example, increasing the number of fleets on high-demand routes could significantly enhance profitability.

H. INVENTORY MANAGEMENT AND FLEET MAINTENANCE

The ERP system enables the company to monitor fleet conditions in real-time, as shown in the Inventory Table. Access to information on spare parts, fuel consumption, and vehicle equipment grants comprehensive control over maintenance needs. Scheduled preventive maintenance minimizes downtime and enhances service reliability.

However, it is crucial to emphasize that effective inventory management through ERP relies heavily on accurate data. The dependency on precise input data presents a challenge, as any errors can disrupt the entire operational system.

I. IMPACT ON WORKFORCE MANAGEMENT

ERP also plays a significant role in workforce management by facilitating the scheduling of drivers and assistants, as illustrated in the Bus Crew Table. The system effectively prevents overlaps or shortages of personnel during trips. Additionally, ERP provides flexibility in adjusting work schedules, particularly in response to sudden changes in departure times. Efficient workforce management not only boosts operational efficiency but also fosters employee satisfaction, which ultimately enhances service quality.

J. RESOURCE EFFICIENCY AND CUSTOMER SERVICE

The Company Planning Results Table illustrates how ERP effectively allocates resources, such as fuel, meals, and passenger amenities, based on travel routes. For example, the longer Malang-Palembang route requires more resources compared to the shorter Malang-Bali route.

This effective resource management showcases how ERP supports cost efficiency. To further enhance service quality, the company can leverage ERP data to assess customer preferences, such as desired meal types, and integrate these insights into strategic decision-making.

K. CHALLENGES AND RECOMMENDATIONS

Despite the significant positive impact of ERP, certain challenges must be addressed. A primary concern is the reliance on data accuracy, which poses a major obstacle. Moreover, successful ERP implementation necessitates consistent system maintenance to ensure reliable operational data.

To tackle these challenges, the company should enhance employee training on ERP management and establish regular audits to verify data accuracy. Furthermore, utilizing historical ERP data can aid the company in predicting demand and better aligning its operational strategies.

CONCLUSION

This study demonstrates that the implementation of ERP in bus companies significantly enhances operational efficiency, particularly in production planning. Utilizing real-time data from the ERP system enables companies to make precise fleet allocations, optimize departure schedules, and adjust capacity according to passenger demand across various routes. Additionally, ERP facilitates more effective inventory management and fleet maintenance, leading to reduced operational costs and minimized downtime. The findings indicate that an integrated ERP system empowers companies to respond swiftly to fluctuations in demand and changing operational conditions. This capability is essential for improving customer service quality and ensuring passenger satisfaction.

The adoption of ERP in the transportation sector represents a strategic advantage. By enhancing operational processes, companies can not only reduce costs but also significantly improve the overall customer experience. Therefore, investing in ERP systems is crucial for bus companies aiming to maintain competitiveness in a dynamic market. Despite the numerous benefits identified, this study acknowledges certain limitations, particularly the reliance on data accuracy and the necessity for ongoing system maintenance. These challenges can impact the effectiveness of the ERP system and should be addressed to maximize benefits.

Future research should explore methods to enhance data accuracy and maintenance protocols for ERP systems. Additionally, studies could investigate the long-term impacts of ERP implementation on customer satisfaction and operational performance across different transportation companies.

In conclusion, the findings suggest that implementing ERP can serve as a strategic solution for overcoming operational challenges in the transportation industry. It promotes the development of efficient business processes that respond effectively to customer needs, ultimately leading to improved service quality and organizational success.

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