Afro-Asian Journal of Scientific Research (AAJSR)
المجلة الأفروآسيوية للبحث العلمي
E-ISSN: 2959-6505
Volume 4, Issue 2, 2026
Page No: 317-323
Website: https://aajsr.com/index.php/aajsr/index
SJIFactor 2024: 5.028 ISI 2025: 0.915 معامل التأثير العربي (AIF) 2025: 0.76

Cost-Benefit Analysis of Predictive Maintenance: Evaluating Economic Impacts and Operational Efficiency

Abdalla Omar Dagroum Ali[1*], Osama Elgadi[2]
[1]Industrial Department, Faculty of Engineering, Sabratha University, Sabratha, Libya.
[2]Mechanical and Industrial Engineering Department, Faculty of Engineering, University of Tripoli, Tripoli, Libya.

تحليل التكلفة والعائد للصيانة التنبؤية: تقييم الآثار الاقتصادية والكفاءة التشغيلية

عبد الله عمر دقروم علي[1*]، أسامة القاضي[2]
[1]قسم الهندسة الصناعية، كلية الهندسة، جامعة صبراتة، صبراتة، ليبيا
[2]قسم الهندسة الميكانيكية والصناعية، كلية الهندسة، جامعة طرابلس، طرابلس، ليبيا

*Corresponding author: dagroum@hotmail.com

Received: March 22, 2026	Accepted: May 07, 2026	Published: May 23, 2026

Abstract:
This paper presents a cost-benefit analysis of predictive maintenance within industrial settings, focusing on its economic impacts and contributions to operational efficiency. As industries increasingly adopt Industry 4.0 technologies, the shift from traditional maintenance strategies to predictive approaches has gained momentum, promising reduced downtime, extended equipment lifespan, and optimized resource allocation. This study systematically evaluates the costs associated with implementing predictive maintenance, including technology acquisition, training, and data management, against the benefits derived from decreased maintenance costs, enhanced productivity, and improved asset reliability. Through reported case studies and quantitative metrics, we analyze various industry sectors to illustrate the return on investment of predictive maintenance initiatives. The findings reveal that while initial investments in predictive maintenance technologies may be substantial, the long-term savings and efficiency gains significantly outweigh these costs. This research underscores the importance of adopting a strategic approach to maintenance planning, providing insights for decision-makers aiming to enhance operational performance while minimizing costs. Ultimately, this paper contributes to the growing body of literature on predictive maintenance by offering a framework for evaluating its financial viability and operational benefits.

Keywords: Cost-Benefit Analysis, Predictive Maintenance, Economic Impacts, Operational Efficiency.

الملخص:
تقدم هذه الورقة البحثية تحليلًا لجدوى التكلفة والعائد للصيانة التنبؤية في البيئات الصناعية، مع التركيز على آثارها الاقتصادية ومساهمتها في كفاءة التشغيل. فمع تزايد اعتماد الصناعات لتقنيات الثورة الصناعية الرابعة، اكتسب التحول من استراتيجيات الصيانة التقليدية إلى أساليب الصيانة التنبؤية زخمًا متزايدًا، واعدًا بتقليل وقت التوقف، وإطالة عمر المعدات، وتحسين تخصيص الموارد. تُقيّم هذه الدراسة بشكل منهجي التكاليف المرتبطة بتطبيق الصيانة التنبؤية، بما في ذلك اقتناء التكنولوجيا والتدريب وإدارة البيانات، مقابل الفوائد المُستمدة من انخفاض تكاليف الصيانة، وتعزيز الإنتاجية، وتحسين موثوقية الأصول. من خلال دراسات حالة منشورة ومقاييس كمية، نحلل قطاعات صناعية مختلفة لتوضيح عائد الاستثمار في مبادرات الصيانة التنبؤية. تكشف النتائج أنه على الرغم من أن الاستثمارات الأولية في تقنيات الصيانة التنبؤية قد تكون كبيرة، إلا أن الوفورات طويلة الأجل ومكاسب الكفاءة تفوق هذه التكاليف بشكل ملحوظ. يؤكد هذا البحث

على أهمية تبني نهج استراتيجي لتخطيط الصيانة، مما يوفر رؤى قيّمة لصناع القرار الذين يهدفون إلى تحسين الأداء التشغيلي مع تقليل التكاليف إلى أدنى حد. في نهاية المطاف، تساهم هذه الورقة في مجموعة الأدبيات المتنامية حول الصيانة التنبؤية من خلال تقديم إطار عمل لتقييم جدواها المالية وفوائدها التشغيلية.

الكلمات المفتاحية: تحليل التكلفة والعائد، الصيانة التنبؤية، الآثار الاقتصادية، الكفاءة التشغيلية.

Introduction:

In today's fast-changing industrial environment, organizations are driven to adopt innovative maintenance strategies in their pursuit of greater operational efficiency and reduced costs. Traditional maintenance methods, which rely on reactive and scheduled maintenance, often result in unexpected downtimes and higher operational costs. In contrast, predictive maintenance (PdM) utilizes cutting-edge technologies, such as Internet of Things (IoT) sensors and data analytics, to continuously monitor equipment condition and predict potential failures before they occur. This revolutionary strategy not only minimize the risk of unexpected breakdowns but also optimizes maintenance schedules, resulting in higher productivity and reduced costs.

The growing availability of data and improvements in analytical techniques have fueled the adoption of PdM in manufacturing and service operations. However, the transition to PdM often requires substantial initial investments in technology, training, and system integration [1,2]. Therefore, conducting a Cost-Benefit Analysis (CBA) is crucial to assess the financial impact of implementing PdM. This analysis helps justify investments while providing insights into the long-term benefits that organizations can gain.

This paper aims to systematically evaluate the economic impacts of PdM by comparing the costs associated with its implementation against the tangible and intangible benefits it delivers. The structure of this paper is organized as follows: Section 2 provides a review of existing literature on PdM and its cost implications; Section 3 outlines the methodology employed for conducting the CBA; Section 4 presents reported case studies highlighting successful PdM implementations; Section 5 discusses the results and implications of the findings; and Section 6 concludes with recommendations for industry practitioners and future research directions.

Literature Review:

The increasing complexity of industrial systems and the drive for operational efficiency have made PdM a crucial area of research and application. As organizations seek to minimize downtime and maximize resource allocation, understanding the cost-benefit implications of PdM becomes essential. This literature review aims to synthesize previous research findings regarding the financial and operational benefits of implementing PdM strategies across various industries.

Renwick and Babson [3] asserted that PdM is a cost-effective strategy for managing plant machinery issues, emphasizing that quality information and effective methodologies are essential for success. When combining these elements, PdM using vibration analysis can significantly reduce machinery downtime and production losses while providing long-term cost benefits through accurate maintenance scheduling. Edwards et al. [4] noted that the construction industry increasingly relies on mechanization for profits, where interruptions can lead to significant tangible and intangible costs, including contract delays and loss of goodwill. Their paper reviews condition-based monitoring and the emerging focus on root cause analysis for failures, presenting initial findings on developing a model to predict breakdowns in construction plant and equipment.

Murry and Mitchell [5] emphasized that careful engine condition monitoring, including vibration and oil analysis, can identify abnormal wear and contamination, indicating potential mechanical issues. Their PdM program for Strategic Petroleum Reserve equipment aims to enhance reliability and reduce costs by preventing major failures and improving maintenance practices. Mustakerov and Borissova [6] addressed the complexities of maintenance planning in rapidly growing industries, highlighting the importance of PdM based on real-time machine condition monitoring. They propose an intelligent approach to defining optimal PdM strategies using a CBA and optimization algorithm, demonstrating its effectiveness through a case study involving a vibrating feeder [6].

Gilabert et al. [7] proposed a methodology for continuously assessing PdM technologies tailored to specific business scenarios, integrating various reliability and maintenance analysis techniques. Their approach includes a Monte Carlo simulation to identify optimal maintenance strategies based on failure probabilities, ultimately enhancing the cost-effectiveness of maintenance processes and improving the quality of maintenance information. Busse et al. [8] presented a method for CBA of PdM, aiming to help maintenance managers decide on its implementation compared to traditional methods. It emphasizes the importance of condition monitoring systems for diagnostics and prognostics and explores how different maturity levels and temporal performance influences potential cost savings.

Bousdekis et al. [9] discussed how Industry 4.0 enhances PdM capabilities, leading to optimized operations while highlighting the often-overlooked business perspectives and managerial barriers associated with these solutions. Their article presents the benefits, business opportunities, and managerial implications derived from their experiences in designing and implementing PdM systems. Adu-Amankwa et al. [10] highlighted a gap in research regarding the expected value of PdM for small-to medium-sized enterprises (SMEs) using CNC machine tools. Their paper presents a cost-effective PdM system architecture that predicts savings between £22,804 and £48,585 for SMEs, demonstrating clear value creation and providing insights for further research into PdM's financial and performance impacts on CNC machine maintenance.

Salvadori et al. [11] proposed a model that quantifies the economic benefits of transitioning from traditional maintenance to PdM, facilitating investment decisions for manufacturers and vendors through a pay-per-performance agreement. Turnbull & Carroll [12] conducted a study about recent advancements in wind turbine condition monitoring systems which enables optimization of operational performance and cost reduction related to component failures. Their study quantifies the cost benefits of PdM and condition-based maintenance strategies, revealing potential savings of up to 8% in direct operational costs and 11% in lost production, while highlighting the advantages of earlier interventions over traditional reactive maintenance.

Meng et al. [13] discussed the challenges of adopting PdM technologies due to the associated costs, emphasizing the importance of calculating return on investment (ROI) for stakeholders. They propose an integrated economic evaluation method using a system dynamics model to analyze incremental costs and benefits, applying it to Lithium-ion batteries, and develop a CBA model and an evolutionary game model to optimize investment strategies and improve decision-making in PdM. Meddaoui et al. [14] highlighted the importance of timely maintenance in achieving manufacturing excellence, emphasizing that PdM can facilitate real-time maintenance, reducing downtime and costs while enhancing production quality. Their paper includes a case study comparing various algorithms for predicting equipment failures in industrial processes, suggesting that future research could leverage additional artificial intelligence tools to improve prediction accuracy.

Frederiksen et al. [15] addressed the challenges of implementing PdM in offshore wind farms, emphasizing the need to understand its short-term impacts and evaluate cost-efficiency. The paper develops a methodology to analyze the marginal impacts of PdM on existing preventive strategies, including a maintenance efficiency measure, which is validated through a case study, demonstrating its effectiveness in supporting cost-benefit estimates. Zhu et al. [16] emphasized the critical role of maintenance techniques in the upcoming industrial revolution, focusing on the evolution and advancements in PdM, including system architectures and optimization methods. They argue that traditional maintenance approaches are inadequate for minimizing costs and downtime, recommending PdM as a solution to enhance system availability and reliability, and they outline various optimization objectives and methods, highlighting future research directions for integrating deep learning in PdM applications.

This paper offers a CBA of PdM specifically tailored for industrial environments, highlighting its significant economic implications and its role in enhancing operational efficiency. By examining the financial advantages and operational improvements associated with PdM, this study aims to provide valuable insights for decision-makers in industries seeking to embrace advanced maintenance strategies. The analysis will explore both the quantitative and qualitative benefits of implementing PdM, shedding light on how these strategies can lead to sustainable growth and competitive advantages in a rapidly evolving industrial landscape.

Methodology:

This section outlines a methodology employed in this paper for conducting the CBA of PdM in industrial environments. The methodology incorporates both quantitative and qualitative aspects to ensure a holistic evaluation of PdM’s impact on businesses. A literature review was performed to compile existing research on PdM implementation, focusing on case studies, financial reports, and technical papers that detail the economic effects of PdM.

The next step involved identifying and categorizing costs associated with the implementation of PdM, including: Initial Investment Costs which estimates were derived from case studies and industry benchmarks (these include expenses related to the acquisition of sensors, data analysis software, integration, and employee training) and Operational Costs (Ongoing costs related to system maintenance, software updates, and personnel salaries were considered).

Then assessment of benefits from PdM implementation that aimed to capture both Quantitative Benefits (Metrics such as reduced downtime, lower maintenance costs, and energy savings were quantified, this involved calculating the total avoided costs associated with failures and downtime against the cost of implementing the PdM system and its operations), and Qualitative Benefits (Factors such as improved safety, enhanced employee morale, and the potential for extended machinery lifespan were evaluated through stakeholder feedback and expert judgment) was conducted.

To evaluate the financial effectiveness of PdM, **ROI can be calculated using the formula:**

$$ROI = \frac{Net\ Benefits}{Total\ Investment} \times 100$$

Net benefits can be derived by subtracting the total costs from the total benefits over a specified time frame, typically ranging between 12 to 24 months for PdM systems

Reported Case Studies: Successful PdM Implementations:

In this section, we present several case studies that exemplify successful implementations of predictive maintenance within various industrial settings. These case studies illustrate the practical applications of PdM, emphasizing diverse industry contexts and the associated tangible outcomes.

- **Case A — Large paper manufacturer:** A prominent paper mill implemented a comprehensive plant-wide PdM system, which included sensors, advanced analytics, and integrated monitoring for critical rotating equipment. The initial investment for this system amounted to approximately €650,000. Following the installation, the facility experienced a significant reduction in unplanned downtime, decreasing by 70%. This improvement resulted in annualized savings of €1.5 million, leading to a notably swift payback period of around five months. Additionally, the net present value (NPV) was strongly positive within the first year of operation. The ROI for the PdM system was calculated at approximately 130 %, this indicates that for every euro invested in the PdM system, the company earns an additional €1.3 in net benefits. This outcome highlights the financial effectiveness of adopting PdM strategies [17].
- **Case B — Siemens Power Generation (gas turbines):** A gas-turbine fleet was equipped with AI-based forecasting using phased capital investments in sensors, telemetry, and an AI platform (costs varying by site). The deployment achieved a 70% cut in unplanned outages and delivered approximately €5.5 million in annual savings for the reported installation, with fault detection windows of up to 36 hours. The strong ROI stems from the high cost of downtime in power generation, and the case shows that high-utilization assets yield exceptional returns while a phased implementation helps mitigate risk [17].
- **Case C — Coca-Cola company:** AI-driven PdM in Coca-Cola's bottling operations delivers substantial operational gains by reducing downtime, lowering maintenance costs, and extending equipment life. Unlike fixed-schedule maintenance, AI analyzes sensor data to detect early signs of deterioration—allowing interventions during planned downtime and preventing in-production failures and quality issues. Across hundreds of plants, modest percentage improvements (e.g., 10% less unplanned downtime, 15% lower maintenance costs) scale to millions in avoided lost production and repair expenses. The system also sequences and times interventions across facilities to minimize production disruption, leveraging low-demand periods for the most intrusive work [18].
- **Case D — ALCOA the American aluminum manufacturer:** The American aluminum manufacturer was conducting a proof of concept involving 50 machines to enhance service levels and lower maintenance expenses. Each of these machines is equipped with sensors that monitor various parameters, including the electrical current. This setup allows for the early detection of any unexpected spikes in current, which may indicate a malfunctioning motor. When an issue arises, such as a damaged belt, it can be quickly identified and fixed, preventing up to twelve hours of unplanned downtime. As a result, this proof of concept leads to an estimated 20% reduction in potential downtime for the selected machines. The investment was recovered its costs within the first six months [19].
- **Case E — Automotive manufacturing:** An automotive manufacturer successfully enhanced its machine uptime by 30% within 24 months of initiating the PdM project. This improvement was facilitated by the installation of temporary sensors, which take only a few minutes to set up on each machine. As a result, the investment in sensor technology was minimal. The data gathered from the sensors included vibrations, infrared temperature readings, ultrasound, and electrical voltage [19].
- **Case F — Digital Edge Indonesia:** In the fast-evolving data center landscape, maintaining high service availability and operational efficiency is crucial. Digital Edge Indonesia has embraced PdM, particularly through the use of thermal imaging technology, to enhance reliability and minimize downtime at its data centers, EDGE1 and EDGE2. This shift from traditional maintenance to proactive strategies aims to mitigate operational risks and is supported by significant findings indicating that predictive maintenance can increase productivity and reduce costs. By developing a web-based thermal imaging system for real-time data collection and anomaly detection, the company has achieved a 50% improvement in operational efficiency and timely detection of

potential failures. Overall, Digital Edge Indonesia's innovative approach exemplifies the industry's move toward smarter, more resilient data center operations [20].

- **Case G — PdM in textile manufacturing:** PdM is increasingly becoming vital in textile manufacturing for maximizing efficiency and minimizing costs. Unplanned machine downtime can significantly impact operations, leading to losses estimated at over $20 billion globally. Traditional maintenance methods are being replaced by Industry 4.0 solutions, which utilize IoT devices to monitor machine performance. Research indicates that such systems can reduce downtime by up to 65% and maintenance costs by 40%. Notable implementations, such as Jaya Shree Textiles' PdM platform, have resulted in a 19% increase in reliability and significant cost savings. Companies like Rieter and Shandong Ruyi have also reported substantial reductions in downtime and waste through advanced monitoring technologies. The integration of PdM with digital twin simulations further enhances efficiency. Despite initial investment costs, subscription models are making these technologies more accessible. As the industry evolves, PdM is becoming essential for operational excellence, sustainability, and competitiveness in the textile sector [21].

Discussion and Implications of Findings:

The results of this study on PdM highlight a significant transformation in industrial maintenance practices, particularly as organizations adapt to the complexities of the Industry 4.0 era. The CBA demonstrates that while the initial investment in PdM systems can be substantial, the long-term economic advantages such as decreased downtime, extended asset life, and reduced maintenance costs are both significant and persuasive.

Analysis of various case studies reveals clear and consistent economic improvements linked to the implementation of PdM. Companies that have adopted these strategies report reductions in unplanned downtime of up to 70%, leading to considerable annual savings. For instance, a large paper manufacturer achieved a ROI of around 130%, indicating that for every euro invested in PdM, a notable return in additional benefits was realized. This strong ROI underscores the financial rationale for adopting PdM, especially in sectors where downtime can result in substantial opportunity costs.

Generally, and based on [17] the ROI of PdM varies significantly across different sectors, reflecting the unique challenges and advantages inherent to each industry. In aviation, the ROI can exceed 10:1, primarily driven by the critical need to meet stringent safety requirements, which necessitate reliable and well-maintained equipment. The oil and gas sector demonstrates a robust ROI ranging from 8:1 to 12:1, as companies leverage PdM to manage complex logistics and mitigate the substantial costs associated with downtime. In manufacturing, the ROI typically falls between 3:1 and 5:1, focusing on enhancing the efficiency of production lines and streamlining operations. These figures underscore the importance of adopting PdM strategies tailored to the specific needs and conditions of each industry.

In addition to the quantitative benefits, the qualitative advantages such as enhanced employee morale, improved safety, and the establishment of a more organized maintenance culture are crucial. By shifting to predictive approaches, organizations not only safeguard against equipment failures but also foster an environment of proactive efficiency.

The operational efficiency implications of PdM are significant. These practices mark a pivotal shift from reactive to proactive maintenance, leading to optimized resource allocation. By leveraging real-time monitoring and advanced data analytics, organizations can transition from rigid maintenance schedules to adaptable, condition-based strategies that reduce waste and enable timely interventions. The case of Coca-Cola illustrated this well, where predictive analytics have allowed for interventions during planned downtimes, effectively minimizing disruptions and improving overall production efficiency.

For decision-makers, the strategic implications of PdM adoption are noteworthy. The necessity of aligning technology with training and cultural shifts within organizations emerges as a critical component for success. While technological investments are crucial, the training and upskilling of personnel play an equally vital role in maximizing the benefits of PdM systems. Companies that navigate this integration effectively are better positioned to leverage the full spectrum of benefits, enhancing both their competitive edge and resilience in the marketplace.

Conclusion:

In summary, the findings from this study highlight the critical importance of adopting predictive maintenance strategies in industrial settings. The economic impacts and operational efficiencies demonstrated underscore the necessity for organizations to embrace technologies that facilitate this transition. As industries continue to adapt to an evolving landscape, the strategic implementation of PdM will not only enhance operational performance but also drive sustainable growth and competitive advantages.

Despite the evident benefits, challenges remain, particularly concerning the investment hurdles faced by small to medium-sized enterprises (SMEs). Future research should focus on developing tailored PdM models that accommodate the budgetary and resource constraints typically experienced by these organizations. Additionally, exploring the integration of advanced technologies, such as Artificial Intelligence and Machine Learning, within PdM frameworks could yield further efficiencies and drive innovation.

References

[1] Mobley, R. K. (2002). An Introduction to Predictive Maintenance (2nd ed.). Butterworth-Heinemann.

[2] Hashemian, H. M., & Bean, W. C. (2011). State-of-the-Art predictive maintenance techniques*. IEEE Transactions on Instrumentation and Measurement, 60(10), 3480–3492. https://doi.org/10.1109/tim.2009.2036347

[3] Renwick, J. T., & Babson, P. E. (1985). Vibration Analysis---A proven technique as a predictive maintenance tool. IEEE Transactions on Industry Applications, IA-21(2), 324–332. https://doi.org/10.1109/tia.1985.349652

[4] Edwards, D. J., Holt, G. D., & Harris, F. (1998). Predictive maintenance techniques and their relevance to construction plant. Journal of Quality in Maintenance Engineering, 4(1), 25–37. https://doi.org/10.1108/13552519810369057

[5] Murry, R., & Mitchell, B. (2002). Cost savings from a practical predictive-maintenance program (pp. 206–209). https://doi.org/10.1109/rams.1994.291109

[6] I. Mustakerov and D. Borissova, "An intelligent approach to optimal predictive maintenance strategy defining," 2013 IEEE INISTA, Albena, Bulgaria, 2013, pp. 1-5, https://ieeexplore.ieee.org/abstract/document/6577666

[7] Gilabert, E., Fernandez, S., Arnaiz, A., & Konde, E. (2015). Simulation of predictive maintenance strategies for cost-effectiveness analysis. Proceedings of the Institution of Mechanical Engineers Part B Journal of Engineering Manufacture, 231(13), 2242–2250. https://doi.org/10.1177/0954405415578594

[8] Busse, A., Metternich, J., Abele, E. (2019). Evaluating the Benefits of Predictive Maintenance in Production: A Holistic Approach for Cost-Benefit-Analysis. In: Schmitt, R., Schuh, G. (eds) Advances in Production Research. WGP 2018. Springer, Cham. https://doi.org/10.1007/978-3-030-03451-1_67

[9] Bousdekis, A., Apostolou, D., & Mentzas, G. (2019). Predictive maintenance in the 4th Industrial Revolution: benefits, business opportunities, and managerial implications. IEEE Engineering Management Review, 48(1), 57–62. https://doi.org/10.1109/emr.2019.2958037

[10] Adu-Amankwa, K., Attia, A. K., Janardhanan, M. N., & Patel, I. (2019). A predictive maintenance cost model for CNC SMEs in the era of industry 4.0. The International Journal of Advanced Manufacturing Technology, 104(9–12), 3567–3587. https://doi.org/10.1007/s00170-019-04094-2

[11] Salvadori, G., Vannini, E., & Tumino, A. (2020, November 6). Industrial IoT : a cost-benefit analysis of predictive maintenance service. https://www.politesi.polimi.it/handle/10589/167108

[12] Turnbull, A., & Carroll, J. (2021). Cost benefit of implementing advanced monitoring and predictive maintenance strategies for offshore wind farms. Energies, 14(16), 4922. https://doi.org/10.3390/en14164922

[13] Meng, H., Liu, X., Xing, J., & Zio, E. (2022). A method for economic evaluation of predictive maintenance technologies by integrating system dynamics and evolutionary game modelling. Reliability Engineering & System Safety, 222, 108424. https://doi.org/10.1016/j.ress.2022.108424

[14] Meddaoui, A., Hain, M., & Hachmoud, A. (2023). The benefits of predictive maintenance in manufacturing excellence: a case study to establish reliable methods for predicting failures. The International Journal of Advanced Manufacturing Technology, 128(7–8), 3685–3690. https://doi.org/10.1007/s00170-023-12086-6

[15] Frederiksen, R. D., Bocewicz, G., Radzki, G., Banaszak, Z., & Nielsen, P. (2024). Cost-Effectiveness of predictive maintenance for offshore wind farms: a case study. Energies, 17(13), 3147. https://doi.org/10.3390/en17133147

[16] Zhu, T., Ran, Y., Zhou, X., & Wen, Y. (2025). A survey on Intelligent Predictive Maintenance (IPDM) in the era of Fully Connected Intelligence. IEEE Communications Surveys & Tutorials, 28, 633–671. https://doi.org/10.1109/comst.2025.3567802

[17] Schueber, E. (2025, March 18). Predictive maintenance: a comparison of costs and benefits - logicline - service!digital. logicline - service!digital. https://www.logicline.de/en/predictive-maintenance-a-comparison-of-costs-and-benefits

[18] Daigle, C. (2026, January 7). How Coca-Cola increased store sales 8% using AI - Chief AI Officer. ChiefAIOfficer.com. https://chiefaiofficer.com/coca-cola-retail-manager-receiving-ai-powered-whatsapp-inventory-recommendations-that-increased-store-sales-by-8-through-optimized-restocking-predictions/
[19] Taod Consulting. (2025, September 3). Predictive Maintenance Projekt: Wartungskosten minimieren. Taod Consulting. https://www.taod.de/blog/predictive-maintenance-als-projekt
[20] Setiadi, A. (2026, May 20). [CASE Study] The use of predictive maintenance in data center operations. Digital Edge Indonesia. https://id.digitaledgedc.com/case-study/case-study-the-use-of-predictive-maintenance-in-data-center-operations
[21] Dubey, M., & Dubey, M. (2025, July 22). Predictive maintenance for textile machinery using IoT. Global Textile Times. https://www.globaltextiletimes.com/uncategorized/predictive-maintenance-for-textile-machinery-using-iot/