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Reliability and Cost Saving Power Plant with Asset Management

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Abstract

Through its industry advancement strategy, electric supply stability ranging from electric generation, transmission to its distribution is a paramount. For this, electric power plant with higher reliability and affordable maintenance cost plays an important role. This research was focused on measuring reliability and maintenance cost saving after implementing a conformal asset management (CAM). CAM with 6 keys subjects and 40 sub-subjects was applied and scored using a maturity level adopted from Bradshaw and Abrahamson. Reliability which is indicated by Equivalent Availability Factor (EAF) and Equivalent Forced Outage Rate (EFOR) was determined, while maintenance cost saving was obtained according to data taken before and after implementing CAM. Data was taken in the year period of 2012 to 2019 which was divided in the period of 2012 to 2014 as data before implementing CAM and 2014 to 2019 as data after implementing CAM. The research found that by implementing CAM to the affiliated electric power plant, the AM maturity level was in range of 2 to 5 from scale 5 or the average level was 3.5. In this, some of sub-subject within subject of Strategy and Planning, Life-Cycle delivery, Asset Information, and Organization and people were critical area identified for improvement. For its reliability and maintenance cost saving, the company has had better reliability and maintenance cost saving after implementing CAM. EAF improved by 10% and EFOR dropped to 2%, while maintenance cost saving increased by 30%.

Keywords: Asset Management, Availability, Electric Power Plant, Forced Outage, Maturity Level.

Introduction

Efficient asset management (AM) is crucial for organizations with complex operations and extensive assets, especially in the energy sector, where reliability and cost-effectiveness are top priorities. Asset management frameworks, such as those outlined in ISO 55001, enable organizations to align asset-related decisions with strategic objectives, ensuring that investments in infrastructure yield long-term benefits (1,2). Strategic alignment is critical as modern systems become increasingly complex, demanding innovative approaches to maintain operational excellence and competitiveness (3). Recent advancements highlight the role of asset management as a bridge between operational performance and organizational goals. Effective AM integrates elements such as risk management, decision-making, and lifecycle cost analysis, promoting sustainability and resilience. At the equipment level, the application of AM is used to make the replacement of time-based equipment strategies with performance-based strategies and to shift from a deterministic approach to a probabilistic approach (4). This application can assist decision-makers in determining steps for the repair and replacement of equipment owned by an organization during the asset life-cycle process (5). At a more strategic implementation level, AM is used as an organizational competitive strategy (6) and is one of the drivers of business movement and digital transformation (7). Therefore, it is important for an organization to understand how strategic AM is within the organization, including its influence on shaping business processes and organizational structures (8). To ensure AM operates effectively and efficiently, human resources with in-depth knowledge of business processes and multidisciplinary skills are required (1). Integration with computer-based maintenance management systems, geographic information, and corporate policy systems presents a significant challenge in supporting decision-making in AM (9).

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These difficulties are further complicated when gray areas persist in management between senior managers and managing managers (3). The AM strategy in ISO 55000 uses the term 'strategic plan,' which reflects a long-term approach to asset management. Investments made without a well-formulated strategic plan risk being directionless and ineffective (10,11). The strategic implementation of AM is not only impactful at the company level but also extends to broader scopes (e.g., government). Ultimately, AM's utilization will lead to the creation of multiple strategies and regulations (12) as well as a regulation-oriented model (13). The application of digital tools and data-driven strategies further enhances AM capabilities, providing real-time insights that improve decision-making (6,13). IAM, in its journey, succeeded in creating a framework to translate the organization's strategic objectives into AM objectives and the principles that guide the development of AM strategies (14). This framework enhances strategic alignment by bridging organizational goals with actionable AM strategies, directly supporting the broader context of operational excellence and long-term sustainability in AM implementation. ISO 55001 stipulates the requirements in the process of developing AM policies in an organization consisting of five categories, namely: Consistency, Accuracy, Commitment, Framework, and Communication. The commitment to meet the optimal implementation needs to be set out in the strategic and sound regulatory role policy of the AM (12,15) and proposed in the form of developing a sustainable asset integrity management framework (16). One of the examples of such development and implementation cases is in the process of determining maintenance policies (17) and optimal performance strategies where the AM model is used as a strategy to overcome the challenges faced by regulators, managers, and operators of public lighting systems (18). On a broader scale, examples of the development and implementation of the AM are in the form of government policies through financial pressure and cost reduction efforts (19). In order for the final results of planning and strategy making to be achieved, the planning and control mechanism of the AM are very important to achieve organizational strategy (6).

The emergence of concepts such as Condition-Based Maintenance (CBM) and Asset Performance Management (APM) emphasizes the shift toward predictive analytics, leveraging data to anticipate failures and optimize maintenance schedules (9). According to previous research findings, the presence of AM plays a strategic role in all aspects of an organization, from upper management levels to lower managerial levels. Commitment and collaboration between levels are also necessary for the successful implementation of AM to achieve the desired objectives. Similar conditions occur in the efforts of power generation units to improve and enhance their performance. The commitment and cooperation demanded from top-level managers from the initial stages of AM implementation to the present have resulted in diverse findings (successful, nearly successful, and unsuccessful). These diverse findings become more prominent when units that have not succeeded in implementing AM belong to groups of generation units that carefully followed the directions of the initiator group.

Despite these advancements, gaps persist in implementing AM frameworks, particularly in tailoring strategies to specific industries. For example, while some previous studies have adopted technologies such as IoT and AI to support asset management, these approaches often focus on technological applications without integrating operational reliability metrics like Equivalent Availability Factor (EAF) and Equivalent Forced Outage Rate (EFOR). Furthermore, the practical implementation of CAM in the power generation industry remains underexplored, particularly in enhancing metrics like EAF and EFOR. Research on how CAM can integrate value drivers and enablers to reduce maintenance costs and improve the operational efficiency of power plants is very rare. This study addresses these gaps by presenting an in-depth analysis of CAM application in the context of power plants, offering more detailed and strategically relevant insights compared to previous approaches (8,20). Conformal Asset Management (CAM), an emerging paradigm, aims to address these challenges by aligning traditional AM principles with industry-specific applications. However, the theoretical foundations of CAM and its advantages over conventional frameworks require further exploration (11).

The effectiveness of AM actions significantly depends on factors that facilitate the existence of elements within the proposed framework. The feedback-modulated framework demonstrates how integrated AM performance improvement principles enhance asset lifecycle performance (9,12). The application of artificial intelligence (AI) also has a significant impact on participation in autonomous maintenance and AM optimization in the electric power industry (11), as well as minimizing the loss of critical information (13). This research utilizes triangulation to validate the impact of asset management implementation in PLN power plants. Triangulation involves the use of multiple data sources and methods to enhance the reliability and validity of research findings. Data were collected through interviews with workers, capturing their experiences before and after asset management implementation, and analyzed using MAXQDA to identify recurring themes and patterns. These results were validated against a radar chart developed by PLN, which highlights key elements of asset management, to determine their alignment with operational changes and worker feedback. The validated elements were further correlated with operational metrics like Equivalent Availability Factor (EAF) and Equivalent Forced Outage Rate (EFOR) to quantify their influence on reliability and efficiency.

Previous studies, such as those conducted at PT Pembangkitan Jawa Bali (PJB), emphasize the critical relationship between asset management (AM) implementation, innovation, and power plant performance. PJB's success in implementing asset management frameworks like PAS 55 and ISO 55001 has significantly improved operational metrics, such as Equivalent Availability Factor (EAF) and Equivalent Forced Outage Rate (EFOR), while fostering continuous innovation (21). Similarly, research analyzing gas turbine performance at PT PJB Muara Tawar highlights the importance of reliability and maintenance strategies in achieving operational excellence, as demonstrated by the effective use of EAF and Capacity Factor (CF) as key performance indicators (22). Further, studies on reliability indices of power plants at PT Cahaya Fajar Kaltim underscore the significance of EAF and EFOR in evaluating operational readiness and forced outage levels, emphasizing the influence of derating and forced outage hours on reliability (23).

Moreover, recent studies on Asset Performance Management (APM) in hydroelectric power plants have introduced advanced data-driven techniques, such as machine learning, for optimizing maintenance and failure detection. These methods demonstrate significant potential for managing high-complexity assets, enhancing availability, reducing costs, and supporting sustainability (8). However, these studies primarily focus on contexts with robust resources and sophisticated infrastructure, leaving a gap in understanding how such practices can be adapted and optimized in organizations with limited resources.

While these studies collectively demonstrate the effectiveness of structured AM frameworks, maintenance strategies, and advanced predictive methods, they fail to address several critical dimensions. Specifically, they do not explore specific elements of innovation or their relationship with the maturity level of AM systems. Organizational factors such as work culture and knowledge transfer remain underexplored. Furthermore, the predominantly quantitative approaches used in these studies often overlook the narrative and contextual aspects of AM practices, particularly in resource-constrained settings. To address these gaps, this research adopts a qualitative approach using MAXQDA to map the elements influencing AM implementation. In light of these gaps, this study poses the following research questions: How does the implementation of Conformal Asset Management (CAM) affect the Equivalent Availability Factor (EAF) and Equivalent Forced Outage Rate (EFOR) in power plants?

The integration of qualitative and quantitative data is a key strength of triangulation, allowing researchers to uncover complex relationships and generate deeper insights (24–26). This approach is particularly effective in identifying critical factors that drive operational improvements while reducing biases inherent in single-method research. Moreover, triangulation facilitates systematic data validation through tools such as MAXQDA, enhancing the research process's reflexivity and enabling iterative refinement of findings (27). By analyzing employee feedback from interviews conducted with PLN staff before and after the implementation of asset management

(AM) strategies, this study leverages triangulation to provide a comprehensive and multidimensional perspective. It explores how AM practices influence power plant performance, bridging strategic frameworks with actionable insights to achieve operational excellence.

This study aims to bridge the identified gaps by presenting a case study on the application of CAM in power plants. By integrating six key AM elements and addressing six key subjects and 40 sub-subjects, this research evaluates the impact of CAM on reliability and cost-effectiveness. Specifically, this study investigates improvements in Equivalent Availability Factor (EAF) and Equivalent Forced Outage Rate (EFOR), metrics crucial for assessing power plant performance (20). The study aims to explore the application of predictive maintenance in enhancing AM outcomes, demonstrating its potential to improve the reliability and cost-effectiveness of power plants. This study aims to identify CAM's unique contributions to asset management in the energy sector, quantify its operational and economic benefits through metrics like EAF and EFOR, and provide a scalable framework for implementing CAM. By addressing these objectives, this study contributes to the growing body of knowledge on sustainable AM practices and offers practical insights for practitioners in the energy sector. This research not only reinforces the value of strategic asset management but also emphasizes its role in driving innovation and ensuring long-term operational success.

Methodology

This study employs a descriptive qualitative method using both primary and secondary data for the 2012-2019 period. The data is divided into two main parts: the 2012-2014 period, which reflects conditions before the implementation of Conformal Asset Management (CAM), and the 2014-2019 period, which reflects conditions after CAM implementation (28–33). The primary data collection process was conducted through direct interviews with respondents selected based on their deep understanding of the asset management (AM) implementation situation within the company. Meanwhile, secondary data was obtained from historical data available at the power plant companies (PLN/PJB), both before and after CAM implementation. A total of 31 respondents participated in this study, as summarized in Table 1, which illustrates the respondents' positions in the organization before and after the implementation.

Table 1: List of Respondence for Interview

Sl. No	Position of respondent in the power plant before implementation	Number of respondence	Position of respondent in the power plant after implementation	Number of respondence
1	General Manager	3	President Director	5
2	Senior Manager	1	Vice President Director	9
3	Manager	16	General Manager	3
4	Assistant Manager	3	Senior Manager	5
5	Senior Analyst	1	Manager	1
6	Top Supervisor	2	Assistant Manager	1
7	Staff	5	Head of Division	2
8			Engineer	1
9			Expert Council	1
10			Retired	3
Total Respondents			**31**	

The interviews focused on questions related to the implementation of CAM before and after the strategy was executed. The primary data obtained from the interviews was then processed using MAXQDA, a software designed to support qualitative data analysis. In MAXQDA, a coding process was carried out to identify key elements and categorize the interview data. The elements generated from this coding process were then compared with secondary data to validate the interview findings, facilitating both thematization and categorization.

The data coding process in this study produced 6 main subjects and 40 sub-subjects representing the key elements of Conformal Asset Management (CAM). These results were visualized in the form of a radar chart to depict the maturity level of each subject and sub-subject. The maturity levels were assessed on a scale from 1 to 5, encompassing the following categories:

- Level 1 (Initial): Limited or no formalized asset management process.
- Level 2 (Emerging): Basic processes are in place but lack integration.
- Level 3 (Implemented): Consistent and formalized processes.
- Level 4 (Integrated): Processes are integrated across the organization.
- Level 5 (Optimized): Processes are fully optimized and continuously improved.

Data Validation

This study employs a non-parametric approach, such as the Chi-Square test, to analyze categorical data in the form of a Likert scale. This approach was chosen because it does not require the assumption of normal distribution, aligning with the characteristics of the survey data. The Chi-Square test is used to validate whether respondents' perceptions of the implementation of Conformal Asset Management (CAM) are statistically significant and relevant to operational outcomes, such as EAF and EFOR, thereby producing more reliable and contextual findings. To validate the relationship between the interview findings and operational data, a data triangulation process was conducted. This triangulation aimed to ensure that the coding results from the interviews were consistent with the variables used in calculating the Equivalent Availability Factor (EAF) and the Equivalent Forced Outage Rate (EFOR). EAF and EFOR were calculated using equations [1] and [2], with supporting operational data such as plant hour, plant outage, plant derating, forced outage hour, and service hour. Additionally, maintenance cost savings resulting from increased EAF and reduced EFOR were analyzed based on maintenance cost data before and after CAM implementation.

Definitions and Calculations of EAF and EFOR

In this research, reliability of electric power plant is indicated by two factors i.e. EAF and EFOR (34); while maintenance cost saving was accounted as a consequences of having better reliability. EAF is defined as the fraction of a given operating period in which a generating unit is available without any outages and equipment or seasonal deratings. While EFOR is define as probability of forced outrage of the power plant due to outage and derating (23). EAF, EFOR and maintenance cost can be determined by Equation 1 and 2.

$$EAF = \frac{AH-(EFDH+EMDH+EPDH)}{PH} x\ 100\% \qquad [1]$$

Where AH is available hour, PH is period hour, EFDH is equivalent forced derated hours, EMDH is equivalent maintenance derated hours, and EPDH is equivalent planned derated.

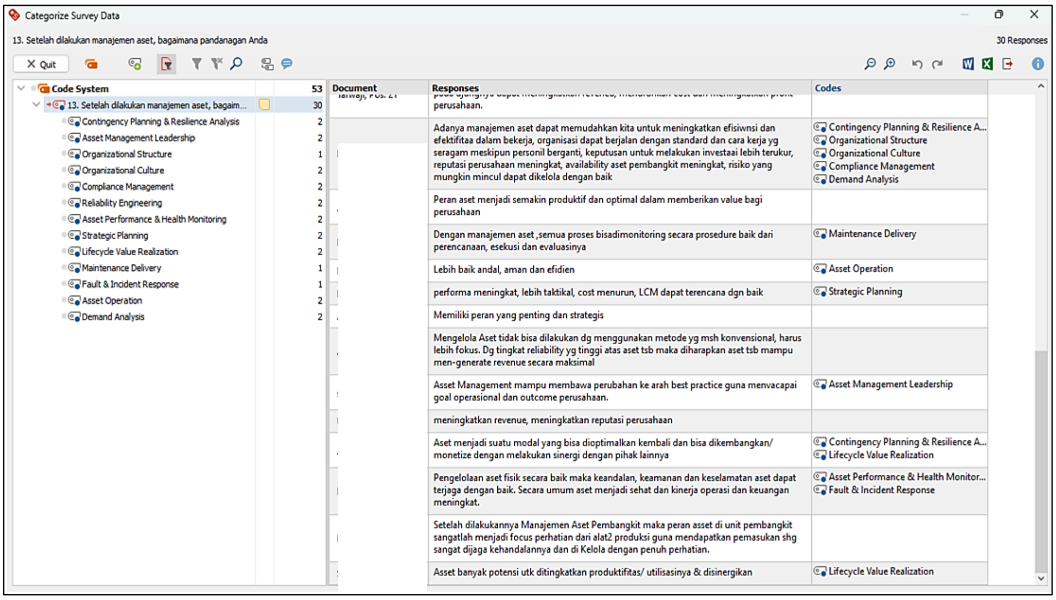
$$EFOR = \frac{FOH+EFDH}{(FOH+SH+ERSFDH)} x\ 100\% \qquad [2]$$

Where FOH is forced outage hour, SH is service hour, EFDH is equivalent forced derated hours and ERSFDH is equivalent reserve shutdown forced derated hours.

Results and Discussion

Assessment of Maturity Levels in CAM Implementation

The results of interviews with 31 respondents, processed using MAXQDA, categorized the data into 6 main subjects and 40 sub-subjects related to the implementation of Conformal Asset Management (CAM), as illustrated in Figure 1. Some subjects scored high (5) on the radar chart, such as Demand Analysis and Asset Creation and Acquisition, reflecting optimal maturity levels in managing asset needs and acquisitions. Other subjects, such as Contingency Planning and Resilience Analysis, Asset Management Policy, and Reliability Engineering, scored well (4), indicating progress in contingency planning, policy development, and asset reliability. Respondents highlighted the success of predictive maintenance techniques and the strengthening of asset management culture, which had a significant impact on improving asset reliability and reducing unexpected outages. The radar chart shown in Figure 2 demonstrates the successful implementation of CAM in optimizing several elements, although knowledge transfer and employee training remain challenges that need to be addressed to achieve further improvements.



13. Setelah dilakukan manajemen aset, bagaimana pandanagan Anda

Code System	53
13. Setelah dilakukan manajemen aset, bagaim...	30
Contingency Planning & Resilience Analysis	2
Asset Management Leadership	2
Organizational Structure	1
Organizational Culture	2
Compliance Management	2
Reliability Engineering	2
Asset Performance & Health Monitoring	2
Strategic Planning	2
Lifecycle Value Realization	2
Maintenance Delivery	1
Fault & Incident Response	1
Asset Operation	2
Demand Analysis	2

Responses	Codes
perusahaan.	
Adanya manajemen aset dapat memudahkan kita untuk meningkatkan efisiwnsi dan efektifitaa dalam bekerja, organisasi dapat berjalan dengan standard dan cara kerja yg seragam meskipun personil berganti, keputusan untuk melakukan investaai lebih terukur, reputasi perusahaan meningkat, availability aset pembangkit meningkat, risiko yang mungkin mincul dapat dikelola dengan baik	Contingency Planning & Resilience A... Organizational Structure Organizational Culture Compliance Management Demand Analysis
Peran aset menjadi semakin produktif dan optimal dalam memberikan value bagi perusahaan	
Dengan manajemen aset ,semua proses bisadimonitoring secara prosedure baik dari perencanaan, esekusi dan evaluasinya	Maintenance Delivery
Lebih baik andal, aman dan efidien	Asset Operation
performa meningkat, lebih taktikal, cost menurun, LCM dapat terencana dgn baik	Strategic Planning
Memiliki peran yang penting dan strategis	
Mengelola Aset tidak bisa dilakukan dg menggunakan metode yg msh konvensional, harus lebih fokus. Dg tingkat reliability yg tinggi atas aset tsb maka diharapkan aset tsb mampu men-generate revenue secara maksimal	
Asset Management mampu membawa perubahan ke arah best practice guna menvacapai goal operasional dan outcome perusahaan.	Asset Management Leadership
meningkatkan revenue, meningkatkan reputasi perusahaan	
Aset menjadi suatu modal yang bisa dioptimalkan kembali dan bisa dikembangkan/ monetize dengan melakukan sinergi dengan pihak lainnya	Contingency Planning & Resilience A... Lifecycle Value Realization
Pengelolaan aset fisik secara baik maka keandalan, keamanan dan keselamatan aset dapat terjaga dengan baik. Secara umum aset menjadi sehat dan kinerja operasi dan keuangan meningkat.	Asset Performance & Health Monitor... Fault & Incident Response
Setelah dilakukannya Manajemen Aset Pembangkit maka peran asset di unit pembangkit sangatlah menjadi focus perhatian dari alat2 produksi guna mendapatkan pemasukan shg sangat dijaga kehandalannya dan di Kelola dengan penuh perhatian.	
Asset banyak potensi utk ditingkatkan produktifitas/ utilisasinya & disinergikan	Lifecycle Value Realization

Figure 1: Categorization Results of Respondent Data Based on CAM Implementation Using MAXQDA

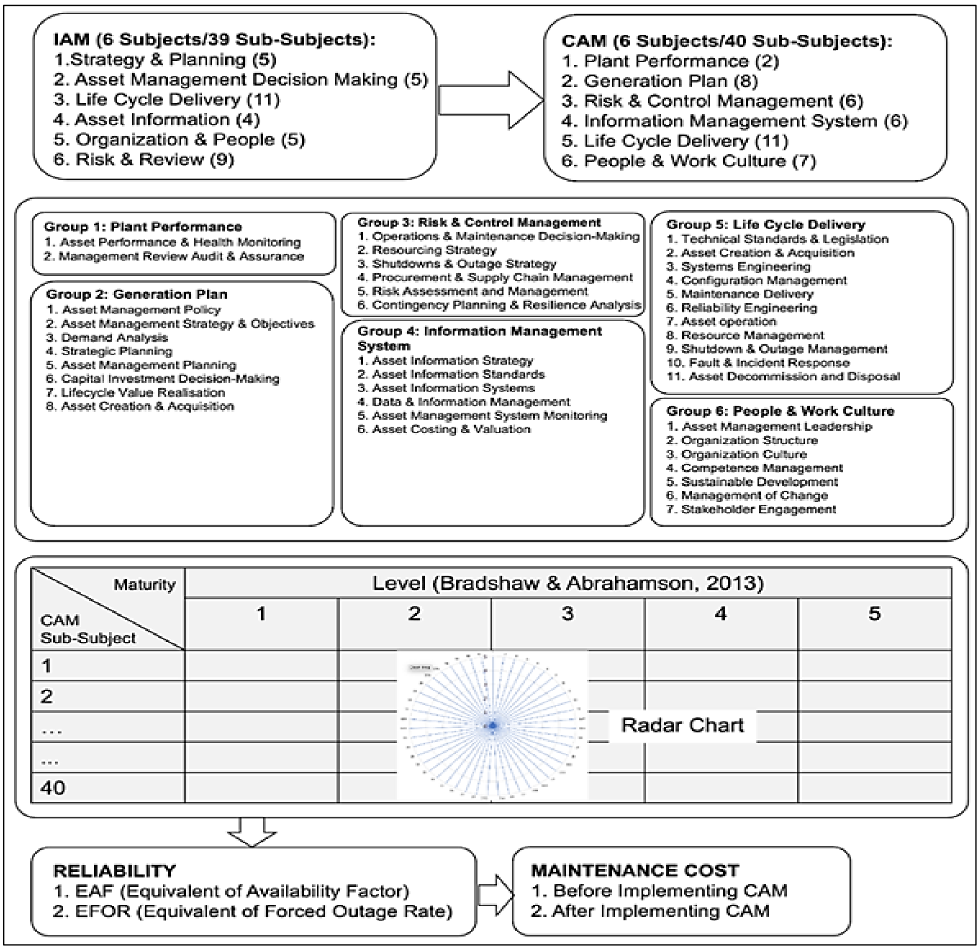


Figure 2: Flowchart of Maturity Mapping and Calculation of Reliability and Maintenance Cost Saving

Statistical Analysis and Implementation Outcomes of CAM

The analysis results show that the majority of respondents gave a score of 5 as an assessment of the implementation of CAM, with a median score of 5, covering 95% of respondents. This indicates that most respondents have a positive perception of the effectiveness of CAM implementation in improving asset management. Statistical testing using the Chi-Square, which is a non-parametric approach, shows that the distribution of respondents' answers is statistically significant, with a p-value < 0.05. This non-parametric approach was used because the data analyzed is categorical (Likert scale), which does not require the assumption of normal distribution in the population, in line with the characteristics of the respondents survey data (35,36). These findings confirm that respondent's perceptions of CAM are not random but reflect consistent and significant patterns, supporting the effectiveness of CAM in improving operational reliability and efficiency in power plants. The results of this research are in the form of the results of the application of CAM based on data of 40 sub-subjects grouped into 6 subjects with scoring based on maturity levels of 1-5 adopted from this reference presented in Figure 3 of the Radar Chart. While the reliability indicated by the decrease in EAF and EFOR scores, and the increase in maintenance cost savings are shown in Figure 4, Figure 5, and Figure 6. The AM system used in this research is adopted from the IAM version of AM with adjustments for organizations with specific characteristics in electric power plant companies.

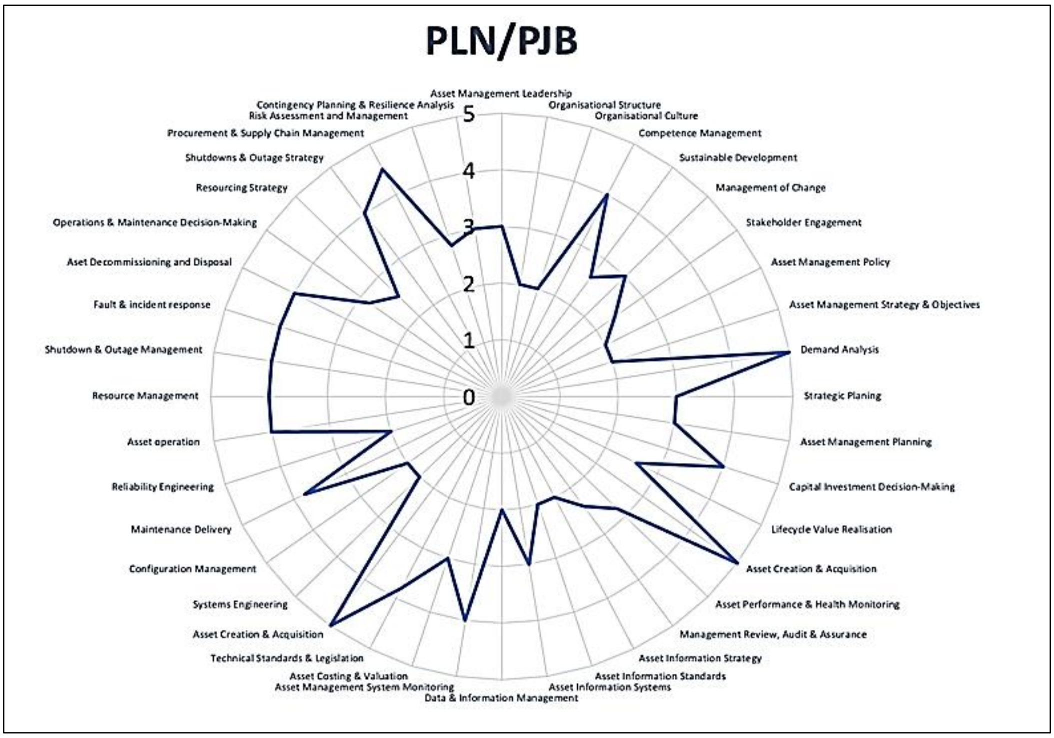


Figure 3: Radar Chart of AM Implementation in Affiliated PLN-PJB

Implementation of Conformal Asset Management (CAM) at PLN/PJB

The implementation of Conformal Asset Management (CAM) at PLN/PJB has been used as an assessment tool to map the maturity level in energy generation governance. Figure 3 shows that the average maturity level after implementing CAM is 3.125, indicating that the organization is at the implementation level and beginning to enter the integration stage. However, several sub-subjects remain at maturity level 2, such as organizational structure and culture, asset information strategies, reliability engineering, and data and information management.

The success of this implementation demonstrates a significant relationship between the maturity level of the implementation process and organizational performance achievements. Generation units with higher maturity levels exhibit better performance achievements. This explanation aligns with findings that adopting an asset governance model suited to an organization's characteristics is key to successful implementation (37).

Implications of Implementation on Equivalent Availability Factor (EAF) and Equivalent Forced Outage Rate (EFOR)

The impact of CAM implementation on operational performance is measured using EAF and EFOR indicators. Figure 4 demonstrates that EAF increased from 84.06% in 2004 to 95.06% in 2019, while Figure 5 highlights a decrease in EFOR from 2.80% to 0.80% during the same period. These improvements underscore CAM's ability to enhance operational reliability and minimize the risk of unexpected disruptions. Moreover, financial benefits are evident in Figure 6, which illustrates a 30% reduction in maintenance costs since the implementation of CAM. The X-axis represents the "Year of Implementation" (2012–2019), while the Y-axis represents "Cost Efficiency (Million IDR)". This demonstrates the declining trend in maintenance costs over the years, highlighting the positive impact of CAM on financial performance. These results align with findings from similar studies. For instance, the implementation of asset management frameworks, such as PAS 55 and ISO 55001, in PT PJB has been linked to significant enhancements in performance metrics, including EAF and EFOR, as well as innovation-driven operational improvements (21). Similarly, a study on gas turbine power plants in PT PJB Muara Tawar revealed that achieving high EAF values directly correlates with reduced forced outages and increased reliability, confirming the importance of robust asset management practices (22). These comparisons validate the positive effects of CAM on power plant performance, demonstrating its potential to replicate similar outcomes across diverse settings. The observed improvements also suggest that CAM fosters both technical efficiency and financial sustainability, offering valuable insights for broader adoption in the energy sector. This study contributes to existing literature by providing a practical framework for scaling CAM's benefits to other industries and operational environments.

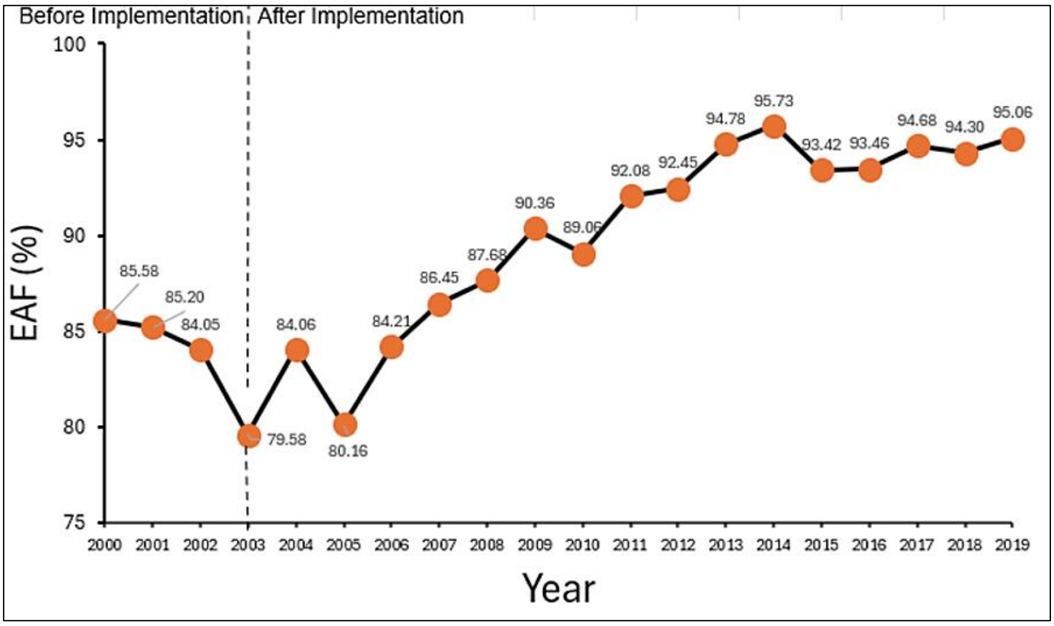


Figure 4: Affect Improving EAF Performance of PLN/PJB Generation

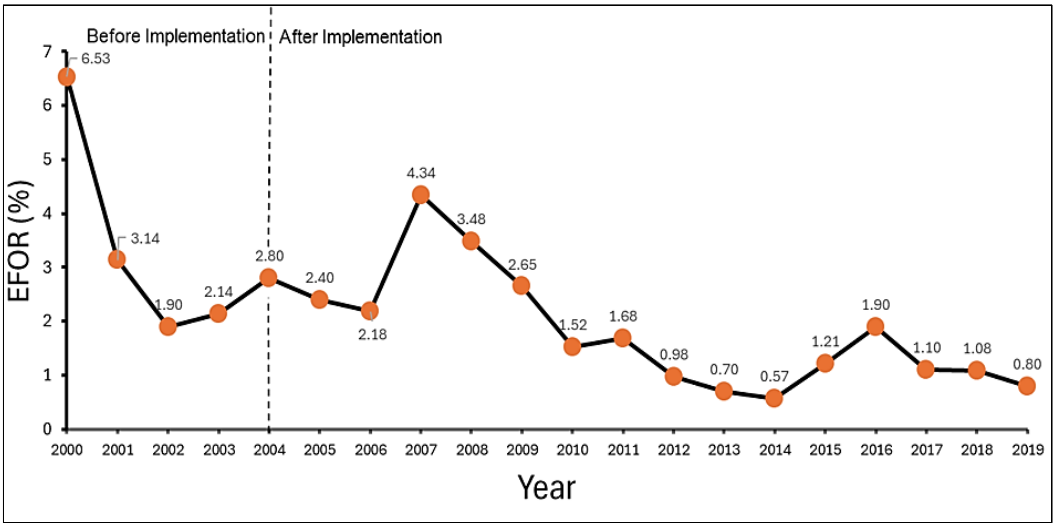


Figure 5: Risk Reduction (EFOR) of PLN/PJB Generation

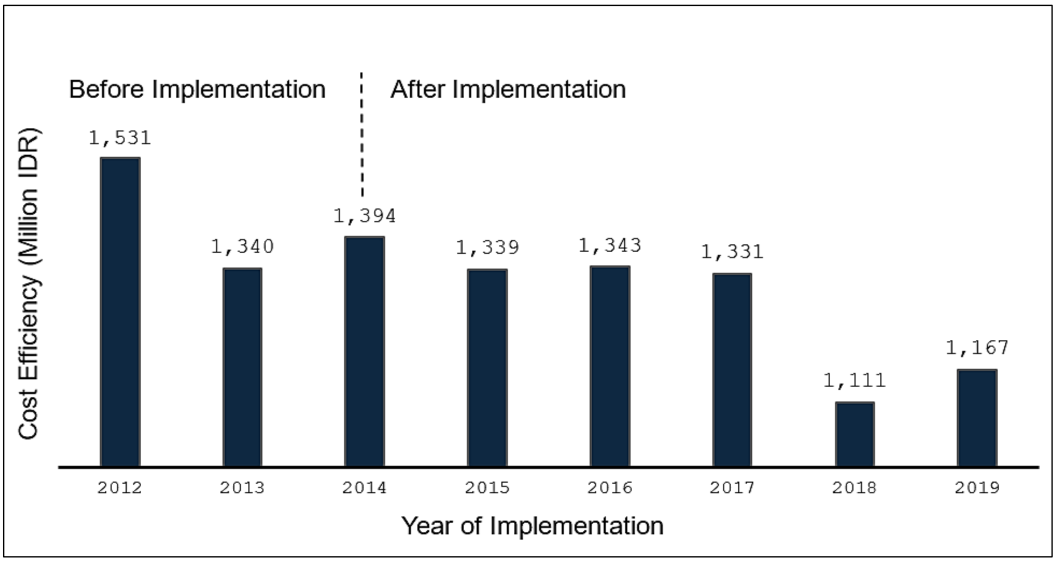


Figure 6. Cost Efficiency of Maintenance of PJB Generation

Challenges in CAM Implementation

Despite the significant results of CAM implementation, several challenges were encountered by the organization during the implementation process, such as:

- Commitment and Management Consistency: High turnover of directors or general managers within 3-7 years may affect the continuity of implementation.
- Knowledge Transfer: A lack of consistency in knowledge transfer across generation units and subsidiaries.
- Budget Allocation: Some decision-makers have not fully optimized the annual budget allocation for technology procurement that could support performance improvement.

These challenges indicate the need for an implementation framework that can be adapted by all generation units to ensure the sustainability of the CAM program, as suggested by researchers.

Factors Influencing Implementation Success

This study identifies six key factors that influence the success of CAM implementation at PLN/PJB:

- Organizational Commitment
- Strategic Policy
- Technology
- Human Resource Competence
- Knowledge Transfer
- Finance

These factors are interconnected, where a general policy for annual budget allocation can facilitate technology procurement and human resource competency development. However, suboptimal budget planning may hinder effective implementation.

Conclusion

The implementation of Asset Management (AM) at PLN/PJB has successfully increased the Equivalent Availability Factor (EAF) by 10%, reduced the Equivalent Forced Outage Rate (EFOR) by 2%, and saved maintenance costs by up to 30%, while also achieving PAS 55 and ISO 55000 certifications. This success serves as a reference for other PLN subsidiaries to implement AM in a reliable, efficient, and sustainable manner. However, challenges such as diverse asset performance, HR competencies, and management KPIs must be addressed through a standardized implementation framework, consistent HR competency development, systematic knowledge transfer, and flexible yet targeted risk mitigation strategies to meet the ever-growing demand for electrical energy.

Abbreviations

AM: Asset Management, AMC: Asset Management Council, APM: Asset Performance Management, CAM: Conformal Asset Management, EAF: Equivalent Availability Factor, EAM: Enterprise asset management, EFDH: Equivalent Forced Derated Hours, EFOR: Equivalent Forced Outage Rate, ERSFDH: Equivalent Reserve Shutdown Forced Derated Hours, FOH : Forced Outage Hour, IAM : Institute of Asset Management, KPI: Key Performance Indicators, LCC: Life Cycle Cost, SAM: Strategic Asset Management, VO: Value Optimization.

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Author Contributions

Iwan Agung Firstantara: Conceptualization, methodology, investigation, data curation, and writing-original draft, Alva Edy Tontowi: Supervision, conceptualization, methodology, reviewing, and editing, Samsul Kamal : Reviewing and editing, Budi Hartono : Reviewing and editing, Andi Rahadiyan Wijaya : Reviewing and editing. All authors of this paper have read and approved the final version submitted.

Conflict of Interest

The authors declare no conflict of interest.

Ethics Approval

This study involved humans as respondents to the interviews (non-interventional study). No experiments or clinical trials were conducted. All participants provided written informed consent prior to engagement in this study.

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