Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/AU04.20250024
Published: November 25, 2025

Reliability of the Electrical Multiple Unit Trainset Maintenance in a Manufacturing Company

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Abstract

The South African railway sector has faced significant challenges in meeting the heightened demand for transportation due to population growth and economic pressures. This paper investigates the reliability issues experienced by a leading rail manufacturing company, which struggles to achieve its target of 90% train availability and reliability, averaging only 75% due to faulty components and inadequate maintenance strategies. The study employs a survey method to identify critical factors affecting reliability and explores potential enhancements to improve operations. Key findings reveal that unclear decision-making processes, lack of employee recognition, insufficient feedback mechanisms, and poor communication hinder reliability efforts. The proposed recommendations emphasize the necessity of structured processes, targeted training, and fostered feedback culture to enhance employee motivation and customer trust. By addressing these barriers, the study aims to contribute actionable insights for improving the reliability of rail transportation systems in South Africa, ultimately leading to greater customer satisfaction and operational efficiency.

Keywords

Reliability, Customer demands, Customer trust, Employee motivation, Maintenance and Communication.

1. Introduction

In the manufacturing environment, reliability has become a critical concept for addressing and managing various challenges, particularly in the railway industry, as highlighted by Meng et al., (2020). Rail transport for commuters has been one of the most used in South Africa by the largest population in SA's big cities and townships, which is primarily used in the major cities and townships and has been the common means of transport for decades and has become a part of South Africans' lifestyle. As the population grows and the SA economy worsens day by day, unemployment rises, and businesses struggle, rail transport becomes a reliable and convenient means of transport, and

due to this, rail transport is the most affordable in South Africa. Due to the high demand as the population grows, more reliable trains are needed to accommodate commuters, especially in peak hours. In Johannesburg, South Africa, a railway manufacturing company strives to ensure 90% availability and reliability for its customers. However, it has consistently achieved only a 75% average in this regard, resulting in a 15% shortfall primarily due to faulty train components and delays in preventive maintenance. This gap creates vulnerabilities in operations, undermines customer trust, and leads to increased rework costs, higher maintenance expenses, and elevated warranty costs resulting from non-compliance. Furthermore, the repetitive nature of these issues diminishes staff morale, ultimately decreasing the company's profitability. Multiple factors contribute to engineering product failures, including wear and tear from continuous use, stress exceeding design limits, weak design elements, manufacturing defects, and environmental factors. Validation and verification are critical for asset reliability, as highlighted by Pandey et al. (2024) . The study aims to address two primary questions: 1) What are the critical success factors for improving reliability? 2)How can the manufacturing company enhance the reliability of its operations? The research aspires to provide actionable insights for enhancing operational efficiency and customer satisfaction by answering these questions.

The organisation of this paper is structured to systematically address the challenges faced by the South African railway sector regarding the reliability of Electrical Multiple Unit (EMU) trainsets. It begins with an abstract that succinctly summarises the core issues, findings, and recommendations of the study. The introduction provides context by discussing the significance of rail transport in South Africa and the critical need for reliability in the face of increasing demand. Following the introduction, a literature review analyses existing research on reliability, identifying critical success factors and strategies for improvement. The paper is further divided into sections that delve into specific factors affecting reliability, including decision-making processes, employee motivation, and communication strategies. The methodology section outlines the survey approach used to gather data, while the results section presents key findings that highlight barriers to reliability. The discussion interprets these findings and proposes actionable recommendations aimed at enhancing operational efficiency and customer satisfaction. Finally, the paper concludes with a summary of insights gained and the potential impact of the research on improving the reliability of rail transportation systems in South Africa.

2. Literature review

According to Shafiq et al. (2024), reliability is the probability that an item will perform its intended function adequately for a specified time under particular conditions. Several studies have identified critical success factors for achieving reliability. For example, Yadav & Singh (2020) highlighted decision-making, data safety, accessibility, laws and regulations, and a quality-driven team in New Delhi's supply chain industry. Moktadir et al. (2020) noted leadership support and top management commitment as essential in Bangladesh’s supply chain. Aghimien et al. (2020), found that trust in digital partners, effective communication, and top management support were crucial in South Africa. This chapter elaborates on the critical success factors necessary for effective reliability management and explores strategies to enhance reliability within organizations.

2.1 The Critical Factors to Improve Reliability

2.1.1 Decision-making

Mohammadi and Rezaei (2020) proposed the Bayesian Best-Worst Method (BWM) as a probabilistic group decision-making model that aggregates preferences from multiple decision-makers, using a hierarchical model to yield reliable outcomes. Insua et al. (2020) highlighted the effectiveness of Bayesian approaches in various fields, including operations research. A recent study by Pei et al. (2024) in the maritime transportation industry emphasized integrating expert assessments into decision-making processes, advocating for the Improved CREAM model to optimize reliability analysis. These frameworks involving Bayesian methods, Markov processes, and other decision theories continue to evolve to enhance system reliability and operational efficiency in the face of increasing safety and complexity demands.

2.1.2 Data management

Alzahrani et al. (2022) identified six techniques to enhance reliability management through data management, including a hybrid approach that combines replication and erasure coding and dynamic structure building for testing data models. Additional techniques involve evaluating storage properties, promoting autonomous storage management, and optimizing data durability and availability. Duchesne and Karangelos (2020) highlighted the role of effective data management in enhancing reliability within various applications, including machine learning and

predictive maintenance strategies. The study concludes that advancing data management techniques, particularly through machine learning methodologies, is vital for improving asset reliability and overall operational efficiency as technology evolves.

2.1.3 Standards and Regulations

Haubler et al. (2020) define standards in railway construction as established guidelines that specify expected quality, safety, and performance within the industry. These regulations, created by organizations such as the International Organization for Standardization (ISO), Institute of Electrical and Electronics Engineers (IEEE), and International Telecommunication Union - Telecommunication Standardization Sector (ITU-T), ensure that software tools meet industry requirements. In the railway construction sector, various standards like ISO 9001, 14001, and 45001 exist for quality, environmental, and occupational health and safety. Regulatory bodies enforce compliance with these standards to ensure public safety and service quality. In South Africa, the Railway Safety Regulator Act 16 of 2002 and entities like the Passenger Rail Agency of South Africa (PRASA) govern railway operations, establishing essential guidelines for design and construction. In conclusion, adherence to continually reviewed and improved standards and regulations is crucial for promoting reliability, safety, and operational efficiency in asset management across various industries.

2.1.4 Organizational structure

Schulman (2020) highlights factors that improve asset reliability through organizational structure. Centralized safety management, with designated safety officers, prioritizes safety and allows decisive actions at the highest level. The study emphasizes the importance of coordinating both macro-level strategy and micro-level communication to ensure effective safety protocols. Additionally, the organizational structure should support a strong safety culture, encouraging resistance to policies that compromise safety, thus safeguarding asset reliability. Fu et al. (2020) argue that active employee participation in decision-making fosters ownership and responsibility for asset reliability. In conclusion, a well-structured organization is essential for enhancing asset reliability by promoting safety, efficiency, and employee engagement while adapting to changing needs.

2.1.5 Top management

Kitsis and Chen (2021) highlight the importance of top management commitment to reliability and maintenance excellence, asserting that fostering a culture of reliability positively influences asset performance. They emphasize the necessity of setting ambitious environmental goals, integrating sustainability practices into operations, and enhancing asset reliability. Moreover, Ma et al. (2021) found that maintaining moderate task-related Faultline strength in TMT can promote endogenous innovation, leading to improved asset reliability. Implementing green technology innovation can also enhance reliability. Additionally, Environmental Information Disclosure (EID) mediates the relationship between green technology and firm performance, increasing stakeholder trust. In conclusion, TMT commitment is crucial for driving sustainability practices and improving asset reliability, reinforcing their role in achieving organizational success.

2.1.6 Knowledge management

Machado et al. (2022) highlight the significance of software tools in facilitating KM. Tools such as Microsoft SharePoint and Confluence support document management and team collaboration, while Knowledge Owl and Bitrix24 enhance knowledge accessibility and productivity. Hosseini et al. (2022) advocate that a systematic approach to KM is essential for maintaining asset reliability in technology-based companies. Knowledge transfer and application improve understanding of reliability factors, enhancing maintenance processes and reducing downtime. In conclusion, effective KM is crucial for enhancing asset reliability and fostering continuous learning while utilizing software tools to promote collaboration and innovation, ultimately improving organizational competitiveness and performance**.**

2.1.7 Communication

Jimada-Ojuolape and Teh (2020) emphasize that implementing redundancies in communication systems can reduce the likelihood of disturbances, improving overall reliability. The study indicates that hard-wired communication methods outperform General Packet Radio Service (GPRS) in reliability, underlining the need for robust communication infrastructure. Moreover, Musheke and Phiri (2021) suggest that improving communication within organizations leads to better understanding and productivity, advocating for communication training and a two-way communication culture. Effective communication enhances decision-making through timely information sharing and

resolves conflicts, fostering employee engagement and collaboration in asset maintenance. In conclusion, effective communication is essential for enhancing asset reliability and organizational success, supported by various communication tools.

2.1.8 Technology

Payette and Abdul-Nour (2023) classify technology tools in asset management into qualitative models and statistical modelling approaches. Qualitative tools, including Fault Tree Analysis (FTA) and Failure Modes and Effects Analysis (FMEA), help identify risks and model system failures. Statistical modeling techniques, like Regression Analysis and Predictive Analytics, are crucial for analyzing data and predicting reliability. Ochuba et al. (2024) emphasize predictive maintenance, IoT integration for real-time performance monitoring, and big data analytics to identify trends and optimize maintenance schedules. In conclusion, employing both qualitative and statistical technology tools is vital for improving asset reliability across industries, providing effective strategies for data analysis and maintenance.

2.1.9 Maintenance strategy

Kamat and Sugandhi (2020) advocate for implementing anomaly detection techniques to enable timely maintenance interventions, preventing costly breakdowns. Deep learning methods, like Long Short-Term Memory (LSTM), analyze complex data interactions for anomaly detection. Zamzam et al. (2021) stress the necessity of a comprehensive maintenance management strategy in the medical equipment industry, utilizing machine learning to predict failures and prioritize maintenance. Regular performance assessments are recommended to support decision-making and align maintenance strategies with national standards. In summary, effective maintenance strategies, such as predictive maintenance and anomaly detection, significantly improve asset health, productivity, and customer satisfaction while minimizing downtime and repair costs.

2.1.10 Organizational culture

Akpa et al. (2021) in Nigeria identifies key factors of organizational culture that improve reliability in asset management. Establishing clear guidelines within a strong culture fosters commitment to shared goals, enhancing efficiency. Additionally, embedded norms provide a decision-making framework, while adaptability allows managers to respond effectively to external changes. Similarly, Lam et al. (2021) emphasize that a culture promoting collaboration, trust, and learning enhances knowledge management and decision-making, further contributing to asset management reliability. In summary, cultivating a robust organizational culture is crucial for achieving sustainable competitive advantages and improving asset management reliability through effective information sharing and collaboration.

2.1.11 Safety

Xu and Saleh (2021) emphasize that safety in reliability asset management aims to minimize risks to personnel and the environment by ensuring safe operation and maintenance of assets. In addition machine learning, safety tools involve risk assessments and audits to identify hazards, ensuring assets function optimally. Linking accident databases with non-accident data can enhance accident prevention strategies. Sasidharan et al. (2022) recommend incorporating climate data and expert opinions in maintaining infrastructure reliability, especially for at-risk bridges. Additionally, implementing risk-informed asset management can optimise decision-making. In summary, prioritising safety is essential for enhancing asset reliability, preventing disruptions, and supporting community resilience through effective management strategies.

3. Methodology

This research utilized a questionnaire consisting of three main questions, along with demographic inquiries. The first section collected demographic information to understand the characteristics of the respondents. The key questions included:

- RQ 1. What are the critical success factors for improving reliability? This is a closed-ended question designed to gather participants' views on the reliability factors implemented in their organizations, using a Likert scale.
- RQ 2. What strategies contribute to reliability in the organisation? This is also a closed-ended question aimed at obtaining participants' opinions on the reliability strategies used in their organisations, again utilising a Likert scale.

RQ 3. What suggestions for improvements are there for methods, strategies, and factors to enhance reliability? This open-ended question invites participants to freely suggest ideas that align with the study's body of knowledge.

Cluster sampling was deemed appropriate for company X due to its ability to accommodate the operational complexities of the organization, which encompasses several large and widely dispersed depots located across various geographical sites and provinces. This dual sampling strategy allowed for a comprehensive and practical approach to data collection, effectively addressing the diverse nature of the population under study

4. Results and Discussion

Fifty employees involved in Rail Asset Management from various departments at a South African rail manufacturing and maintenance company were identified and invited to complete the questionnaire, all of whom agreed to participate in the study. The questionnaire included questions on study-related topics and demographics. The main findings comprise of the three survey questions on the study; Q1: What are the Critical Success factors to improve reliability? Q2: What are the strategies that contribute to reliability used in your organization? Q3: What are the Improvement suggestions on methods, strategies and factors to improve reliability? The results will display both numerical and descriptive statistics.

4.1. Demographic information

This section presents the self-reported demographic information of participants meeting study inclusion criteria, including frequencies and percentages based on their responses in designated categories.

Table 1. Demographic information

Age Group Description			Highest Qualification			Years Of Experience In Railway Industry		
Category	No of response	Related %	Category	No of response	Related %	Category	No of response	Related %
36-40 years	23	46%	Post Matric Diploma or Certificate	8	16%	6-10 years	17	34%
31-35 years	11	22%	Baccalaureate Degree(s)	26	52%	1-5 years	13	26%
26-30 years	7	14%	Honors' Degree (s)	11	22%	11-20 years	16	32%
41-45 years	4	8%	Master's Degree (s)Honour's Degree	5	10%	Less than a year	4	8%
20-25 years	4	8%	**Total**	**50**	**100%**	**Total**	**50**	**100%**
45-50 years	1	2%						
Total	**50**	**100%**						

The participants in the study displayed a diverse age, highest qualification and years of experience in railway industries distribution in Table 1, with the majority (46%) falling within the 36 to 40 years category, and a total of 82% aged between 26 and 40 years. In terms of educational qualifications in Table1, majority 52% of respondents held Baccalaureate Degrees, and a total of 84% possessed a matriculation certificate along with various university qualifications. When assessing experience in railway asset management from Table 1, a majority 34% of participants had 5 to 10 years of experience, followed by 32% with 11 to 20 years of experience. Notably, 66% of participants had between 6 to 20 years of experience in the industry. This information shows the demographic of the well-intended group, that is in a better position to understand and respond to my questions. This demographic information enhances the validity and reliability of the study results.

This section presents the participants' opinions and evaluates how these opinions relate to the factors that the organization employs to enhance reliability. Participants rated these critical factors using a Likert scale, with the corresponding weights displayed in Table 2. Additionally, the frequencies and percentages associated with each level of agreement are provided. The internal consistency, assessed using Cronbach's alpha, was found to be 0.79. This suggests a good reliability for the questionnaire. The analysis indicates that the various questions in the survey are significantly related to one another, exhibiting a strong relationship when compared to the overall differences in responses. In Table 2, 54% of participants agreed that the decision-making process is clearly defined, while 28% were

neutral and 18% disagreed. For Item 2, 52% agreed that regular assessments of data management quality are conducted, with 30% neutral and 18% disagreeing. Regarding employee training effectiveness (Item 3), 70% agreed, 22% were unaware, and 8% disagreed. Similar patterns were noted across Items 4 to 12. And as overall most Items on statistical results have high responses in categories that agree, which indicates that the participants suggest a strong understanding of the factors influencing reliability, and most agree that they are implemented.

Table 2: Critical Success factors to improve reliability.

Items	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Total
1. The decision-making process is clearly defined	0 0%	9 18%	14 28%	23 46%	4 8%	50
2. Regular assessments of data management quality are conducted to identify any inconsistencies.	2 4%	7 14%	15 30%	20 40%	6 12%	50
3. Employees receive training on how to apply established standards effectively.	0 0%	4 8%	11 22%	26 52%	9 18%	50
4. Our organization consistently complies with all relevant regulations that impact reliability	0 0%	3 6%	12 24%	29 58%	6 12%	50
5. Roles and responsibilities are clearly defined within the organization structure, promoting accountability	0 0%	6 12%	13 26%	23 46%	8 16%	50
6. Top management recognizes and rewards individuals who contribute to improving organizational reliability.	2 4%	8 16%	19 38%	14 28%	7 14%	50
7. Employees have easy access to the knowledge resources they need to perform their roles reliably	1 2%	1 2%	6 12%	34 68%	8 16%	50
8. There is an open feedback culture where employees feel comfortable communicating their thoughts and concerns with management	4 8%	10 20%	19 38%	11 22%	6 12%	50
9. Our technology systems are well-integrated, enabling smooth data flow enhancing overall operational reliability	1 2%	12 24%	10 20%	23 46%	4 8%	50
10. Our organization employs a proactive maintenance strategy that focuses on preventing equipment failures before they occur.	0 0%	4 8%	13 26%	26 52%	7 14%	50
11. Our organizational culture promotes accountability, encouraging employees to take responsibility for their actions, which enhances overall reliability.	2 4%	6 12%	13 26%	23 46%	6 12%	50
12. Our organization demonstrates a strong commitment to safety as a critical component of operational reliability	0 0%	4 8%	4 8%	25 50%	17 34%	50

Table 3 presents descriptive statistics for factors enhancing reliability practices within the organisation, showing an overall weighted average (WA) score of 3.6. Items ranked 1 to 7, with Relative Importance Index (RII) scores between 82% and 70%, indicate good standing and a positive influence on reliability. Conversely, items ranked 8 to 12, with RII scores from 69% to 62%, highlight areas needing improvement. Notably, the top item, "Our organisation demonstrates a strong commitment to safety as a critical component of operational reliability," scored the highest WA of 4.1 and an RII of 82%. Rank 2, concerning employee access to knowledge resources, scored 3.9 with an RII of

79%. The findings categorise items ranked 1 to 7 as highly important factors, while items ranked 8 to 12 are viewed as medium-important, indicating opportunities for further enhancement of reliability practices.

Table 3: Descriptive statistics of Critical Success factors to improve reliability.

Items	Weighted Average (WA)	Relative important index Percentage (RII)	Rankings
12. Our organization demonstrates a strong commitment to safety as a critical component of operational reliability	4,1	82%	1
7. Employees have easy access to the knowledge resources they need to perform their roles reliably	3,9	79%	2
3. Employees receive training on how to apply established standards effectively.	3,8	76%	3
4. Our organization consistently complies with all relevant regulations that impact reliability	3,8	75%	4
10. Our organization employs a proactive maintenance strategy that focuses on preventing equipment failures before they occur.	3,7	74%	5
5. Roles and responsibilities are clearly defined within the organization structure, promoting accountability	3,7	73%	6
11. Our organizational culture promotes accountability, encouraging employees to take responsibility for their actions, which enhances overall reliability.	3,5	70%	7
1. The decision-making process is clearly defined	3,4	69%	8
2. Regular assessments of data management quality are conducted to identify any inconsistencies.	3,4	68%	9
9. Our technology systems are well-integrated, enabling smooth data flow enhancing overall operational reliability	3,3	67%	10
6. Top management recognizes and rewards individuals who contribute to improving organizational reliability.	3,3	66%	11
8. There is an open feedback culture where employees feel comfortable communicating their thoughts and concerns with management	3,1	62%	12

This section examines strategies for enhancing organizational reliability based on participant feedback, utilizing a Likert scale for rating. Cronbach's alpha revealed an internal consistency score of 0.420, indicating low reliability among the scale items. In Table 4, 52% of participants agreed that strategic reliability goals are well communicated, while 66% felt encouraged to suggest process improvements. Although 28% were uncertain and 20% disagreed on communication, a majority showed strong alignment with the ideas presented, suggesting a solid understanding of factors influencing reliability and general agreement on their implementation.

Table 4: Strategies to improve reliability practice

Items	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Total
Strategic goals related to reliability are effectively communicated throughout the organization, promoting alignment.	2 4%	8 16%	14 28%	21 42%	5 10%	50 100%
Employees are encouraged to contribute ideas for process improvements, fostering a culture of reliability throughout the organization.	2 4%	5 10%	10 20%	19 38%	14 28%	50 100%
Knowledge management Our organization maintains a centralized knowledge repository that provides easy access to critical information needed for reliable decision-making.	0 0%	5 10%	19 38%	21 42%	5 10%	50 100%
Our strategies prioritize customer satisfaction, ensuring that the reliability of the product meets customer expectations	0 0%	1 2%	10 20%	31 62%	8 16%	50 100%

This section discusses strategies for improving organizational reliability based on participants' feedback. A Likert scale was used to rate these strategies, but Cronbach's alpha indicated an unacceptable level of internal consistency (0.420). The strategies are ranked by their Relative Importance Index (RII) in Table 5. The highest-ranked strategy focuses on prioritizing customer satisfaction, with a weighted average score of 3.9 and an RII of 78%, deeming it highly important. The second strategy encourages employee input for process improvements, receiving a WA of 3.8 and an RII of 75%, also classified as highly important. The first three items are categorized as high-important factors, while the fourth is seen as medium-high or medium-important. Overall, the strategies demonstrate varying levels of importance.

Table 5: Strategies to improve reliability practice

Items	Weighted Average (WA)	Relative important index Percentage (RII)	Rankings
Our strategies prioritize customer satisfaction, ensuring that the reliability of the product meets customer expectations	3,9	78%	1
Employees are encouraged to contribute ideas for process improvements, fostering a culture of reliability throughout the organization.	3,8	75%	2
Knowledge management Our organization maintains a centralized knowledge repository that provides easy access to critical information needed for reliable decision-making.	3,5	70%	3
Strategic goals related to reliability are effectively communicated throughout the organization, promoting alignment.	3,4	68%	4

4.1.1. Reliability Improvement Suggestions

This section presents three categorized questions aimed at collecting suggestions for methods and strategies to enhance reliability and identify potential improvement actions. Figure 3 summarises these suggestions. Out of 50 targeted participants, 20 responded, yielding a participation rate of 40%. Their comments were analyzed qualitatively by extracting key messages, identifying significant concepts and actions, and grouping similar ideas. The categories are displayed in Figure 1, arranged in descending order from the most frequently suggested to the least suggested.

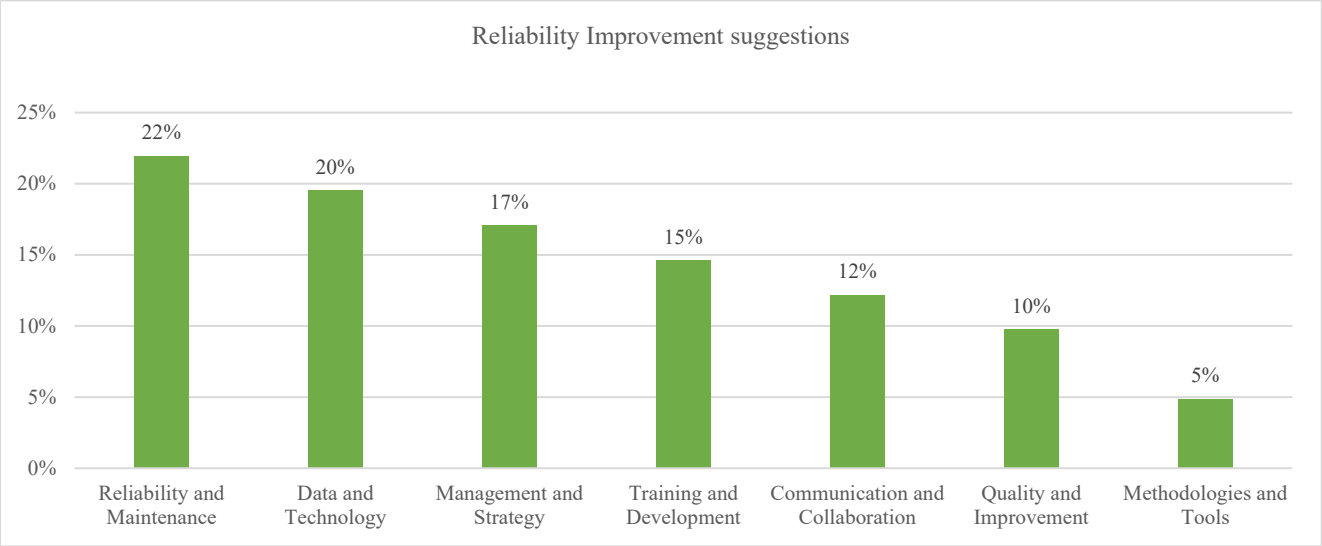

Figure 1. Reliability Improvement suggestions.

The analysis of participant feedback reveals several key themes and areas for improvement within the organisation. The most prominent theme was reliability and maintenance, accounting for 22% of responses. Participants emphasised the need to enhance maintenance tools, adopt proactive approaches, and improve the quality of labour. Recommendations included improving equipment maintenance data, implementing predictive maintenance practices, and employing reliability-centred maintenance (RCM). Important strategies such as condition-based monitoring and rapid-response maintenance were also highlighted.

The second theme, data and technology, represented 20% of responses. Participants stressed the significance of reliable data input, storage, and analytics, advocating for centralised data management and real-time data utilisation. Advanced technologies like Qlik Sense and AI applications were deemed crucial for boosting organizational efficiency.

Management and strategy formed the third category at 17%, pointing out gaps in supplier management and the need for better meeting management, skills transfer, and performance incentives. Suggestions included the adoption of planned agendas and Just-In-Time (JIT) practices to enhance operational strategies.

Training and development were recognized in 15% of feedback, with emphasis on employee training and workforce development. Enhancing teamwork and refining training processes were deemed vital for improving reliability practices.

Communication and collaboration, comprising 12% of responses, highlighted the need for improved communication strategies, teamwork, and employee engagement to foster a supportive organizational environment.

Lastly, quality and improvement garnered 10% of feedback, focusing on quality assurance and customer satisfaction, while methodologies and tools represented the least concern, at 5%. Participants suggested implementing methods like 8D, QRQC, and Kaizen to enhance operational effectiveness. Collectively, these insights provide a roadmap for enhancing reliability and overall organizational performance.

However the limitations of the study results are:
Limitation 1: The research team used the survey for data collection meaning the participants to ask follow-up questions and to as for further clarity before they answering the questions. This also limits the research team to engage further and ask clarity on answers provided.
Limitation 2: The study cannot be generalised across the world, or across south African manufacturing because the study focuses on 1-organisation in Johannesburg, Gauteng province south Africa.

Limitation 3: The study is focused on rolling stock sector in the rail industry that can be also referred as rail fleet/ trainsets and therefore cannot be generalised across different types of stock in rail, or across other kinds of fleet.

5. Proposed Future Improvements

The study examined the critical success factors and descriptive results at Table 2, shows Items ranked 8 to12 categorized as medium-high and considered a medium-important factor than the rest high imported items. It is perceived as having medium relative importance compared to the other evaluated items. Of which the same items ranked 8 to 12,on Table 2 numerical statistics results has more responses on Neutral and disagree which indicates that the participants suggests a less understanding of these factors influencing reliability and also disagrees that they are implemented,As a result the organisation should focus on improving those items by putting it in place and make sure the items are properly manged then address the staff periodically via training or workshop ,even ask for feedback back if the staff is satisfied to further improve on Items; 1) the process of decision making, 2) Data management and accessibility,3) systems technology integrations, 4) How and when Top management select people to be rewarded of good work,5) feedback culture and comfortable communication. And the same should be implanted to improve on Item 6) thorough communication on the organisation and departmental strategic goal On Table 5 on Strategies to improve reliability practice, where this item ranked 4 considered a medium-important factor than the rest of high important items and in Table 4 more responses on Neutral and disagree which indicates that the participants suggests a less understanding of these factors influencing reliability and also disagrees that they are implemented. In edition points of improvement from the suggestions made to reliability improvement 7) Maintenance strategies emerged as the top concern, emphasizing the need for better maintenance tools and proactive approaches, including predictive maintenance practices and reliability-centred maintenance (RCM). 8) Management and strategy pointed to gaps in supplier management and the necessity of Just-In-Time (JIT) practices,9) ensuring quality and continuous improvement.

6. Conclusion

This study investigated critical success factors for improving reliability through a literature review and questionnaire. It also examined the strategies and methods employed to enhance reliability. The findings revealed that there is limited

use of maintenance strategies, highlighting the need for improved maintenance tools and proactive approaches, including predictive maintenance practices and reliability-centred maintenance (RCM). Furthermore, data and technology issues were noted, particularly regarding data collection and management, alongside the necessity of implementing real-time data analysis and advanced technologies such as AI applications. The study identified blind spots affecting both direct operational teams and support functions, including the top management, within Rail Asset Management Company X, and provided essential recommendations to enhance the reliability and availability of trainsets. Key issues contributing to train unreliability included inadequate maintenance, poor data management, misalignment of management strategies with employee efforts, gaps in training and development, unclear communication and collaboration, insufficient quality improvement processes, and a lack of industrial methodologies and tools. Future research should involve a broader range of companies, countries and benchmark strategies to enhance reliability across the global asset management market.

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