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OPERATIONAL FACTORS INFLUENCING TRAIN SERVICE DELIVERY EFFICIENCY IN TANZANIA: A CASE OF THE "STANDARD GAUGE RAILWAY CORRIDOR FROM DAR ES SALAAM TO DODOMA

[1] George Gration Mshumbusi and Angela Runyoro[2]

[1]Student, Faculty of Logistics and Business Studies, Department of Logistics and Transport studies, National Institute of Transport, P. O Box 705, Dar es Salaam, Tanzania

[2]Senior Lecturer, Department of Computing and Communication Technology, National Institute of Transport, P.O. Box 705, Dar es Salaam, Tanzania.

E-mail: georgemshumbusi@gmail.com

Abstract

This study assesses Operational factors influencing Train Service Delivery Efficiency in Tanzania. A long the Dar es Salaam–Dodoma Standard Gauge Railway Corridor Anchored on the Resource Based View theory (RBV), it assessed three specific objectives, namely the influence of railway maintenance practices on train service delivery efficiency, the effect of spare parts availability on train service delivery efficiency and the effect of budget allocation adequacy on train service delivery efficiency.. Study adopted a positivist philosophy and quantitative approach underpinned by deductive cross sectional design from a target population of 260 personnel at Tanzania Railways Corporation, a sample of 158 drawn through randomly sampling technique, of who 156 returned filled questionnaires (98.73% response rate). Data were collected by questionnaire method and analyzed in IBM SPSS Statistics version 24, through Descriptive and Inferential statistics. The findings revealed that operational factors play an important role in train service delivery efficiency. Regarding maintenance practices, operational staff revealed that preventive maintenance activities are conducted regularly (M = 3.56) and strongly agreed that effective maintenance improves train service delivery efficiency (M = 4.54). However, respondents expressed less positive perceptions regarding maintenance planning and scheduling (M = 2.97), prompt response to operational faults (M = 2.65), and consistency of inspection routines (M = 2.66). Regarding effect of spare parts availability, The findings showed that the availability of spare parts remains a challenge, as reflected in the low mean scores for procurement lead time (M = 2.15), dependence on imported spare parts (M = 2.25), and availability of critical spare parts (M = 2.27). while, respondents revealed positive ratings to supply chain effectiveness (M = 4.12) and inventory management (M = 4.26). They also strongly agreed that the availability of spare parts improves train service delivery efficiency (M = 4.61). Also on effects of budget allocation adequacy, The findings showed that maintenance financing remains a challenge, as indicated by the low mean scores for funding spare parts procurement (M = 2.15), timely release of maintenance budgets (M = 2.23), sufficiency of maintenance funds (M = 2.27), and reliability of financial support (M = 2.30). However, respondents strongly agreed that adequate budget allocation is important for effective maintenance and improved train service delivery efficiency (M = 4.34).The study concludes that railway maintenance practices, spare parts availability, and budget allocation adequacy are critical determinants of train service delivery efficiency along the Dar es Salaam–Dodoma SGR corridor It recommends that Tanzania Railways Corporation (TRC), policymakers, and other relevant stakeholders strengthen railway maintenance practices, ensure timely procurement and availability of critical spare parts, and provide adequate and reliable funding for maintenance activities, To enhance improving on service delivery efficiency. Further research could incorporate a qualitative

approach to explore the underlying factors contributing to maintenance challenges, delays in spare parts procurement, inadequate or delayed budget allocation, and their effects on train reliability, punctuality, and overall service delivery efficiency.

Keywords: Train service delivery efficiency, spare parts availability, budget allocation adequacy, maintenance practice, and Standard gauge railway

1. Introduction

Railway transport plays an important role in economic growth, regional integration, and sustainable transportation by facilitating the movement of passengers and goods. In recent years, developing countries, particularly in Africa, have invested in Standard Gauge Railway (SGR) systems to improve transport capacity, reduce travel time and costs, and enhance operational efficiency (Katuga et al., 2023). Tanzania has similarly invested in the electrified SGR to modernize its transport infrastructure and improve connectivity between major economic centers.

The Dar es Salaam–Dodoma SGR corridor is a strategically important route connecting Tanzania's commercial and administrative capitals. It is expected to facilitate passenger and freight transportation, reduce road congestion, and support socioeconomic activities (TRC, 2024). However, achieving efficient train service delivery depends on effective management of railway operations and resources. Train service delivery efficiency is reflected in aspects such as punctuality, reliability, operational continuity, frequency of delays, and timely resolution of faults.

Three important factors that may influence train service delivery efficiency are railway maintenance practices, spare parts availability, and budget allocation adequacy. Effective maintenance practices, including preventive maintenance, inspection, scheduling, and timely fault response, can reduce equipment failures and service interruptions (Binder et al., 2023; Nethamba & Grobbelaar, 2023). Similarly, timely availability of spare parts supports repairs and reduces equipment downtime, while delays in procurement and shortages of critical components may disrupt railway operations (Gao et al., 2024). Adequate and timely budget allocation is also necessary to support maintenance activities, procurement of spare parts, infrastructure management, and other operational requirements.

Despite substantial investment in Tanzania's SGR, limited empirical evidence exists on how these operational and resource-related operational factors influencing train service delivery efficiency, particularly along the Dar es Salaam–Dodoma corridor. Existing studies have largely focused on technical and infrastructural aspects of railway systems, with limited attention to the combined influence of maintenance practices, spare parts availability, and budget allocation adequacy on service delivery efficiency. Therefore, this study assessed Operational factors influencing train service delivery efficiency along the Dar es Salaam–Dodoma SGR corridor,

2.0 Literature review

2.1 Theoretical review

The study was guided by the Resource-Based View (RBV) Theory. The theory was originally developed by Jay Barney in 1991 and has remained one of the most influential theories in strategic management and organizational performance studies. The Resource-Based View posits that an organization's performance depends on its ability to acquire, develop, and effectively utilize valuable resources and capabilities. Recent literature emphasizes that the RBV continues to provide a useful framework for understanding how internal organizational resources contribute to performance outcomes. The theory argues that

tangible resources such as financial assets, infrastructure, equipment, and inventories, together with intangible resources such as managerial capabilities, organizational processes, and technical expertise, are critical determinants of organizational efficiency and effectiveness (Davis & DeWitt, 2021; Gupta et al., 2024). The Resource-Based View further suggests that organizational capabilities play a significant role in transforming available resources into desired outputs.

In the context of railway transport operations, the RBV provides a relevant theoretical lens for explaining train service delivery efficiency. Railway maintenance practices represent organizational Maintenance practices represent important organisational capabilities that enable railway operators to maintain infrastructure and rolling stock in good operating conditions. Effective maintenance practices help minimize equipment failures, reduce service interruptions, and improve operational reliability (D'Oria et al., 2021). Spare parts availability constitutes a critical physical resource required for timely maintenance and repair activities. Adequate availability of spare parts facilitates the prompt replacement of worn or damaged components, thereby reducing downtime and enhancing service continuity (Barney, 1991). Budget allocation adequacy represents a financial resource that supports maintenance activities, procurement of spare parts, workforce development, and other operational requirements necessary for efficient railway service delivery (Barney, 1991).

According to the Resource-Based View (RBV), the effective management and utilization of organisational resources and capabilities contributes to improved organizational performance (Barney, 1991; D'Oria et al., 2021). Within the railway sector, adequate maintenance practices, sufficient spare parts availability, and appropriate budget allocation are therefore expected to contribute to improved train service delivery efficiency through enhanced punctuality, reliability, safety, and operational continuity

2.2 Empirical Literature Review

2.2.1 Maintenance Practices and Train Service Delivery Efficiency

Maintenance practices have been widely recognized globally as an important determinant of train service delivery efficiency because they are associated with reliability, punctuality, safety, and operational continuity. Recent empirical studies examined how modern maintenance approaches, maintenance planning, and resource allocation contribute to railway operational performance. In the African context, maintenance practices are also recognized as important determinants of railway performance, although systems often face challenges such as aging infrastructure and limited technological capacity. (Nethamba & Grobbelaar, 2023) found that the adoption of machine learning-based predictive maintenance in the South African railway industry improves infrastructure reliability, reduces equipment failures, and enhances operational efficiency. However, the study also highlighted that institutional and technical constraints limit the full effectiveness of these maintenance practices in improving train service delivery efficiency (Nethamba & Grobbelaar, 2023).

2.2.2 Availability of Spare Parts and Train Service Delivery Efficiency

The availability of spare parts is a critical determinant of train service delivery efficiency because it is closely associated with maintenance turnaround time, equipment reliability, and operational continuity. Recent empirical studies have demonstrated that effective spare parts management, inventory control, and timely availability of critical components are essential for reducing equipment downtime and supporting reliable railway operations (Baigozhina et al., 2025; Wang et al., 2025). Similarly, research on railway maintenance has emphasized the importance of coordinating spare parts inventory planning with maintenance requirements to ensure the timely execution of maintenance activities (Babai et al., 2024). Studies in Africa Empirical evidence on spare parts availability in African railway systems remains

limited. However, studies on railway maintenance management in Africa indicate that shortages of maintenance materials and spare parts are among the major factors contributing to equipment failures, prolonged repair times, and reduced operational efficiency. In the South African railway sector, challenges related to spare parts procurement and inventory management have been identified as significant barriers to effective maintenance and reliable service delivery, particularly in aging railway systems where replacement components are often difficult to obtain (Nethamba & Grobbelaar, 2023).

2.2.3 **Budget Allocation Adequacy and Train Service Delivery Efficiency**

Budget allocation adequacy is a critical factor in enhancing train service delivery efficiency because it determines the availability of financial resources for maintenance activities, infrastructure renewal, workforce management, and operational improvements. Adequate and reliable financial allocation enables railway organizations to maintain infrastructure quality, support effective maintenance, improve service reliability, and minimize operational disruptions (African Development Bank, 2016; World Bank, 2023). Study conducted in South African railway industry found that limited financial resources hinder the implementation of modern maintenance technologies and operational improvements. The study further indicated that inadequate funding contributes to maintenance backlogs, infrastructure deterioration, and reduced operational reliability, ultimately affecting train service delivery efficiency (Nethamba & Grobbelaar, 2023).

2.3 Research Gap

Existing studies have shown that maintenance practices, spare parts availability, and budget allocation are important operational factors influencing train service delivery efficiency. Effective maintenance practices contribute to operational reliability and reduce service disruptions (Nethamba & Grobbelaar, 2023), while adequate availability of spare parts helps minimize equipment downtime and improve maintenance responsiveness (Gao et al., 2024). Similarly, adequate budget allocation supports infrastructure maintenance, operational efficiency, and continuity of railway services (Gkonou et al., 2023). However, most existing studies have been conducted in developed countries, particularly in Europe and Asia, while research in Africa has focused largely on South Africa. Consequently, limited empirical evidence exists regarding the combined influence of maintenance practices, spare parts availability, and budget allocation adequacy on train service delivery efficiency in East African railway systems, particularly in Tanzania. Therefore, this study addresses this contextual and empirical gap by examining the influence of these factors on train service delivery efficiency along the Dar es Salaam–Dodoma Standard Gauge Railway (SGR) corridor.

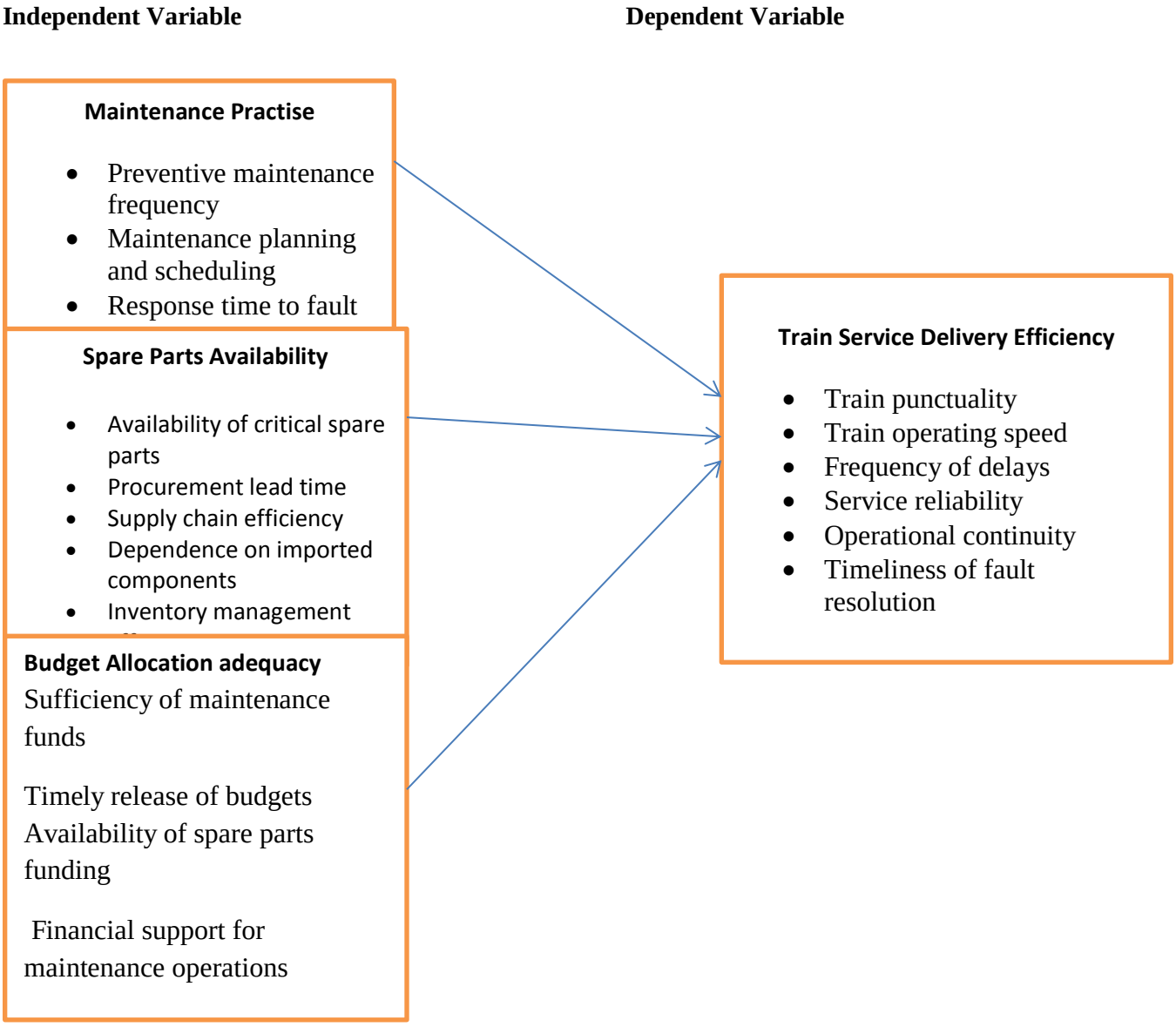
2.4 conceptual framework

This study is guided by a conceptual framework that illustrates the relationship between operational factors influencing train service delivery efficiency along the Dar es Salaam Dodoma Standard Gauge Railway corridor.

The framework is built on the assumption that railway service performance is influenced by how well key operational resources are managed. Specifically, maintenance practices, Availability of spare parts and budget allocation adequacy are considered the independent variables, while train service delivery efficiency is the dependent variable. The relationship is grounded in empirical evidence that operational and resource related factors significantly influence railway system performance (Cheng et al., 2020; Li & Chen, 2021)

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Conceptual Framework



Source: (Cheng et al., 2020; Li & Chen, 2021).

3.0 Methodology

The study adopted the positivism research philosophy because it is appropriate for studies that involve objective measurement and testing relationships between variables (Saunders et al., 2019). Also it adopted a quantitative research approach because it aimed to measure operational factors influencing Train Service Delivery Efficiency through numerical data and statistical analysis. a cross-sectional research design was adopted as it allowed data to be collected from different respondents at a single point in time.

The study area was Dar es Salaam–Dodoma section of Standard Gauge Railway corridor. The target population comprised 260 operational staffs taken from Tanzania Railways Corporation (TRC, 2025). The study adopted randomly sampling technique to select respondents. The sample size of 158 was determined using Yamane's (1967) formula for finite populations however 156 respondents respond which is equal to 98.73%. primary data were collected through structured questionnaire and analyzed using IBM SPSS version 24 for both descriptive and inferential statistical techniques whereby Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize the key study variables, including maintenance practices, spare parts availability and budget allocation adequacy. Also inferential statistics was used for analysis. Content validity was ensured through expert review of the research instrument, The reliability of the research instrument was assessed using Cronbach's Alpha. The analysis produced a Cronbach's Alpha coefficient of 0.911 for the 27 items included in the scale, while the standardized Cronbach's Alpha was 0.875. According to commonly accepted thresholds, an alpha value above 0.90 indicates excellent internal consistency.

4.0 Finding

4.1 Demographic Characteristics of Respondents

This subsection describes the demographic profile of the 156 respondents involved in the study.

Table 4.1 Demographic Characteristics of Respondents

Characteristics	category	Frequency	Percent
GENDER	Male	104	66.7%
	Female	52	33.3%
AGE	18-25	23	14.7%
	26-35	91	58.3%
	36-45	35	22.4%
	46 And Above	7	4.5%
DEPARTMENT	Directorate of Signaling Electrification and Telecommunication	20	12.8%
	Directorate of Railway Traffic	38	24.4%
	Directorate of Civil Engineering	24	15.4%
	Directorate of Rolling Stock	38	24.4%
	Other	36	23.1%

Source: Field data (2026)

The table presents the distribution of respondents by gender. Out of the 156 respondents who participated in the study, 104 (66.7%) were male and 52 (33.3%) were female. This indicates that male respondents constituted the majority of the study participants, while female respondents represented about one-third of the sample.

Age distribution show that 23 respondents (14.7%) were aged 18–25 years, 91 respondents (58.3%) were aged 26–35 years, 35 respondents (22.4%) were aged 36–45 years, and 7 respondents (4.5%) were aged 46 years and above. The results indicate that the 26–35 years age group constituted the majority of the respondents, accounting for more than half of the total sample.

The table shows that respondents were drawn from different departments involved in the operation and management of the Standard Gauge Railway (SGR). Out of the 156 respondents, 38 (24.4%) were from the Directorate of Railway Traffic, 38 (24.4%) from the Directorate of Rolling Stock, 36 (23.1%) from other departments, 24 (15.4%) from the Directorate of Civil Engineering, and 20 (12.8%) from the Directorate of Signaling, Electrification and Telecommunication.

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4.2 Experience of respondent

Table 4.2 Experience of Respondent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	LESS THAN 13 YEAR	13	1.9	1.9	1.9
	1-5 YEAR	72	46.2	46.2	48.1
	6-10 YEAR	64	41.0	41.0	89.1
	ABOVE 10 YEARS	17	10.9	10.9	100.0
	Total	156	100.0	100.0	

Source: Field data (2026)

The table shows that the majority of respondents had substantial work experience in railway operations. Whereby, 72 (46.2%) had 1–5 years of experience, 64 (41.0%) had 6–10 years, 17 (10.9%) had more than 10 years, and only 3 (1.9%) had less than one year of experience. The findings indicate that 87.2% of the respondents had between 1 and 10 years of experience,

4.3 Reliability of a Research Instrument

The reliability of the research instrument was assessed using Cronbach's Alpha. The analysis produced a Cronbach's Alpha coefficient of 0.911 for the 27 items included in the scale, while the standardized Cronbach's Alpha was 0.875. According to commonly accepted thresholds, an alpha value above 0.90 indicates excellent internal consistency..

Table 4.3 Reliability Statistics

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.911	.875	27

Source: Field data (2026)

4.4 Influence of railway maintenance practices on train service delivery efficiency.

The first objective was to assess the influence of railway maintenance practices on train service delivery efficiency. Descriptive statistics were used to assess the variable of railway maintenance practice whereby Respondents were presented with five statements on the variable. And their responses have been summarized on the table..

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Table: 4.4 Descriptive Statistics of influence of Maintenance Practice

	N	Minimum	Maximum	Mean	Std. Deviation
FAULT AFFECTING OPERATION	155	1	5	2.65	1.380
INSPECTION ROUTINE	155	1	5	2.66	1.461
MAINTENANCE ACTIVITIES SCHEDULE	156	1	5	2.97	1.400
PREVENTIVE MAINTENANCE	156	1	5	3.56	1.137
EFFECTIVE MAINTENANCE ON SDE	155	1	5	4.54	.808
Valid N (listwise)	155				

Source: Field data (2026)

Districtive statistics for Table 4.4 showed that respondents generally agreed that preventive maintenance activities are conducted regularly (M = 3.56), indicating that preventive maintenance is reasonably practiced within the railway system. Respondents also strongly agreed that effective maintenance improves train service delivery efficiency (M = 4.54), making it the strongest indicator and demonstrating a clear perception that maintenance is essential for reliable and efficient train operations.

However, respondents were less positive regarding maintenance planning and scheduling (M = 2.97), prompt response to operational faults (M = 2.65), and consistency of inspection routines (M = 2.66), suggesting weaknesses in these maintenance management areas.

Table 4.5 Pearson Correlations between maintenance practice and service delivery

		preventive maintenance	maintenance activities schedule	fault affecting operation	inspection routine	effective maintenance on sde
PREVENTIVE MAINTENANCE	Pearson Correlation	1	.430	.373	.300	.200
	Sig. (2-tailed)		.000	.000	.000	.013
	Sum of Squares and Cross-products	200.481	106.231	90.516	76.852	28.394
	Covariance	1.293	.685	.588	.499	.184
	N	156	156	155	155	155
MAINTENANCE ACTIVITIES SCHEDULE	Pearson Correlation	.430	1	.739	.692	-.059
	Sig. (2-tailed)	.000		.000	.000	.466
	Sum of Squares and Cross-products	106.231	303.897	220.226	218.323	-10.290
	Covariance	.685	1.961	1.430	1.418	-.067

	N	156	156	155	155	155
FAULT AFFECTING OPERATION	**Pearson Correlation**	.373	.739	1	.813	-.176
	Sig. (2-tailed)	.000	.000		.000	.029
	Sum of Squares and Cross-products	90.516	220.226	293.484	252.548	-30.194
	Covariance	.588	1.430	1.906	1.640	-.196
	N	155	155	155	155	155
INSPECTION ROUTINE	**Pearson Correlation**	.300	.692	.813	1	-.148
	Sig. (2-tailed)	.000	.000	.000		.067
	Sum of Squares and Cross-products	76.852	218.323	252.548	328.555	-26.819
	Covariance	.499	1.418	1.640	2.133	-.174
	N	155	155	155	155	155
EFFECTIVE MAINTENANCE ON SDE	**Pearson Correlation**	.200*	-.059	-.176	-.148	1
	Sig. (2-tailed)	.013	.466	.029	.067	
	Sum of Squares and Cross-products	28.394	-10.290	-30.194	-26.819	100.477
	Covariance	.184	-.067	-.196	-.174	.652
	N	155	155	155	155	155

Correlation is significant at the 0.01 level (2-tailed).

Pearson correlation analysis was conducted to examine the relationships between railway maintenance practice variables and train service delivery efficiency (SDE). The results showed that preventive maintenance was positively and significantly related to maintenance activities scheduling ($r = 0.430$, $p < 0.01$), fault affecting operation ($r = 0.373$, $p < 0.01$), inspection routine ($r = 0.300$, $p < 0.01$), and effective maintenance on SDE ($r = 0.200$, $p < 0.05$). In addition, maintenance activities scheduling had strong positive relationships with fault affecting operation ($r = 0.739$, $p < 0.01$) and inspection routine ($r = 0.692$, $p < 0.01$). The strongest relationship was observed between fault affecting operation and inspection routine ($r = 0.813$, $p < 0.01$), indicating that inspection activities are closely associated with operational fault management.

4.5 Effect of Spare Parts Availability On Train Service Delivery Efficiency

The descriptive statistics were computed to assess respondents' perceptions on second specific objective states that effects of spare parts availability on train service delivery efficiency. Respondents were presented with six statements on spare parts availability and their responses are summarized in table below

Table: 4.6 Descriptive Statistics on Spare Parts Availability On Train Service Delivery Efficiency

	N	Minimum	Maximum	Mean	Std. Deviation
PROCUREMENT LEAD TIME OF SPARE	155	1	5	2.15	1.244
DEPENDENCE ON IMPORTED SPARE	154	1	5	2.25	1.349
CRITICAL SPAREPARTS AVAILABILITY	154	1	5	2.27	1.242
SUPPLY CHAIN EFFECTIVELY	153	1	5	4.12	1.019
INVENTORY MANAGEMENT ON STOCK LEVEL	154	1	5	4.26	.948
AVAILABILITY OF SPARE PARTS ON SDE	154	1	5	4.61	.708
Valid N (listwise)	152				

Source: Field data (2026)

Discriptive statistics for table 4.6 revealed that procurement lead time ($M = 2.15$, $SD = 1.244$), dependence on imported spare parts ($M = 2.25$, $SD = 1.349$), and critical spare parts availability ($M = 2.27$, $SD = 1.242$) were rated low, suggesting that delays in procurement and limited availability of critical spare parts remain key challenges affecting maintenance operations. Conversely, respondents

agreed that supply chain processes were effective (M = 4.12, SD = 1.019) and that inventory management practices adequately maintained stock levels (M = 4.26, SD = 0.948). Furthermore, respondents strongly agreed that the availability of spare parts significantly influences train service delivery efficiency (M = 4.61, SD = 0.708).

Table 4.7: Correlations for spare parts availability and SDE

		critical spareparts availability	procurement lead time of spare	supply chain effectively	dependence on imported spare	inventory management on stock level	availability of spare parts on sde
CRITICAL SPAREPARTS AVAILABILITY	Pearson Correlation	1	.839	-.077	.652	-.072	-.171
	Sig. (2-tailed)		.000	.344	.000	.375	.035
	Sum of Squares and Cross-products	236.084	198.344	-14.855	166.294	-12.980	-22.804
	Covariance	1.543	1.296	-.098	1.094	-.085	-.150
	N	154	154	152	153	153	153
PROCUREMENT LEAD TIME OF SPARE	Pearson Correlation	.839**	1	-.050	.670**	-.077	-.171
	Sig. (2-tailed)	.000		.543	.000	.341	.034
	Sum of Squares and Cross-products	198.344	238.284	-9.588	172.325	-13.974	-23.039
	Covariance	1.296	1.547	-.063	1.126	-.091	-.151
	N	154	155	153	154	154	154
SUPPLY CHAIN EFFECTIVELY	Pearson Correlation	-.077	-.050	1	-.279	.457	.455
	Sig. (2-tailed)	.344	.543		.000	.000	.000
	Sum of Squares and Cross-products	-14.855	-9.588	157.882	-58.235	67.294	49.941
	Covariance	-.098	-.063	1.039	-.383	.443	.329
	N	152	153	153	153	153	153
DEPENDENCE ON IMPORTED	Pearson Correlation	.652	.670	-.279	1	.011	-.070
	Sig. (2-tailed)	.000	.000	.000		.893	.390

SPARE	Sum of Squares and Cross-products	166.294	172.325	-58.235	278.623	2.130	-10.195
	Covariance	1.094	1.126	-.383	1.821	.014	-.067
	N	153	154	153	154	154	154
INVENTORY MANAGEMENT ON STOCK LEVEL	Pearson Correlation	-.072	-.077	.457	.011	1	.609
	Sig. (2-tailed)	.375	.341	.000	.893		.000
	Sum of Squares and Cross-products	-12.980	-13.974	67.294	2.130	137.610	62.584
	Covariance	-.085	-.091	.443	.014	.899	.409
	N	153	154	153	154	154	154
AVAILABILITY OF SPARE PARTS ON SDE	Pearson Correlation	-.171	-.171	.455	-.070	.609	1
	Sig. (2-tailed)	.035	.034	.000	.390	.000	
	Sum of Squares and Cross-products	-22.804	-23.039	49.941	-10.195	62.584	76.623
	Covariance	-.150	-.151	.329	-.067	.409	.501
	N	153	154	153	154	154	154

Correlation is significant at the 0.01 level (2-tailed).

Table 4.7 of Pearson correlation analysis revealed that critical spare parts availability was very strongly and positively related to procurement lead time ($r = 0.839$, $p < 0.01$) and strongly related to dependence on imported spare parts ($r = 0.652$, $p < 0.01$). Procurement lead time was also strongly associated with dependence on imported spare parts ($r = 0.670$, $p < 0.01$), indicating that procurement and import dependence are closely connected challenges. Furthermore, supply chain effectiveness showed significant positive relationships with inventory management ($r = 0.457$, $p < 0.01$) and spare parts availability on SDE ($r = 0.455$, $p < 0.01$). The strongest positive relationship with train service delivery efficiency was observed between inventory management on stock level and availability of spare parts on SDE ($r = 0.609$, $p < 0.01$), suggesting that effective inventory control substantially improves train service delivery efficiency. Conversely, critical spare parts availability ($r = -0.171$, $p < 0.05$) and procurement lead time ($r = -0.171$, $p < 0.05$) were negatively associated with spare parts availability on SDE, indicating that shortages of critical spare parts and procurement delays tend to reduce train service delivery efficiency.

4.6 Effect of budget allocation adequacy on train service delivery efficiency.

Descriptive statistics were computed to assess respondents' perceptions regarding the third objective states that effect of budget allocation adequacy on train service delivery efficiency. Respondents were presented with five statements on budget allocation adequacy and their responses are summarized in Table below

Table: 4.8: Descriptive Statistics on Budget allocation adequancy on SDE

	N	Minimum	Maximum	Mean	Std. Deviation

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	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
FUNDING FOR PROCURE OF SPARE	155	1	5	2.15	.103	1.278
MAINTENANCE BUDGET RELEASED ON TIME	154	1	5	2.23	.106	1.313
MAINTENANCE FUND SUFFICIENT	154	1	5	2.27	.109	1.354
RELIABILITY OF MAINTENANCE FINANCIAL	155	1	5	2.30	.109	1.355
ADEQUATE BUDGET ALLOCATION ON MAINTENANCE	154	1	5	4.34	.085	1.050
Valid N (listwise)	152					

Source field data (2026)

Descriptive statistics Table 4.8 of Budget allocation adequacy indicate that respondents generally perceived maintenance financing as inadequate and unreliable, as reflected by the low mean scores for funding for spare parts procurement (M = 2.15), timely release of maintenance budgets (M = 2.23), sufficiency of maintenance funds (M = 2.27), and reliability of maintenance financial support (M = 2.30). However, respondents strongly agreed that adequate budget allocation for maintenance is important (M = 4.34). Overall, the findings suggest that adequate, timely, and reliable budget allocation is a critical determinant of effective maintenance and improved train service delivery efficiency along the Dar es Salaam–Dodoma SGR corridor

Table 4.9: correlation analysis of Budget allocation adequacy

		Maintenance Fund Sufficient	Maintenance Budget Released On Time	Funding For Procure Of Spare	Reliability Of Maintenance Financial	Adequate Budget Allocation On Maintenance
MAINTENANCE FUND	Pearson Correlation	1	.894	.875	.808	-.201
	Sig. (2-tailed)		.000	.000	.000	.013

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SUFFICIENT	Sum of Squares and Cross-products	280.545	242.621	232.000	227.455	-43.614
	Covariance	1.834	1.596	1.516	1.487	-.287
	N	154	153	154	154	153
MAINTENANCE BUDGET RELEASED ON TIME	Pearson Correlation	.894	1	.865	.806	-.103
	Sig. (2-tailed)	.000		.000	.000	.205
	Sum of Squares and Cross-products	242.621	263.584	222.623	220.013	-21.301
	Covariance	1.596	1.723	1.455	1.438	-.140
	N	153	154	154	154	153
FUNDING FOR PROCURE OF SPARE	Pearson Correlation	.875	.865	1	.802	-.094
	Sig. (2-tailed)	.000	.000		.000	.248
	Sum of Squares and Cross-products	232.000	222.623	251.587	214.026	-19.260
	Covariance	1.516	1.455	1.634	1.390	-.126
	N	154	154	155	155	154
RELIABILITY OF MAINTENANCE FINANCIAL	Pearson Correlation	.808	.806	.802	1	-.044
	Sig. (2-tailed)	.000	.000	.000		.590
	Sum of Squares and Cross-products	227.455	220.013	214.026	282.748	-9.519
	Covariance	1.487	1.438	1.390	1.836	-.062
	N	154	154	155	155	154
ADEQUATE BUDGET ALLOCATION ON MAINTENANCE	Pearson Correlation	-.201	-.103	-.094	-.044	1
	Sig. (2-tailed)	.013	.205	.248	.590	
	Sum of Squares and Cross-products	-43.614	-21.301	-19.260	-9.519	168.760
	Covariance	-.287	-.140	-.126	-.062	1.103
	N	153	153	154	154	154

Correlation is significant at the 0.01 level (2-tailed).

5.0 Discussion of Finding

5.1 influence of railway maintenance practices on train service delivery efficiency

The findings revealed a relatively high level of agreement among respondents regarding the contribution of effective railway maintenance practices to train service delivery efficiency. Specifically, the statement that effective maintenance improves train service delivery efficiency recorded the highest mean score (M = 4.54, SD = 0.808), followed by the regular conduct of preventive maintenance activities (M = 3.56, SD

= 1.137). These results indicate that respondents recognise the importance of effective and preventive maintenance in maintaining railway infrastructure and rolling stock in good operating conditions, minimising equipment failures, and enhancing the reliability and continuity of train services. These findings are consistent with previous studies which established that maintenance activities are essential for railway system sustainability, while poorly planned maintenance can negatively affect train punctuality and operational efficiency (Ivina & Palmqvist, 2024). Similarly, research conducted in the South African railway industry found that adopting machine learning-based predictive maintenance improves infrastructure reliability, reduces equipment failures, and enhances operational efficiency, although institutional and technical constraints may limit the full effectiveness of these maintenance practices (Nethamba & Grobbelaar, 2023).

5.2 effect of spare parts availability on train service delivery efficiency

The findings revealed that respondents rated procurement lead time (M = 2.15, SD = 1.244), dependence on imported spare parts (M = 2.25, SD = 1.349), and critical spare parts availability (M = 2.27, SD = 1.242) relatively low, suggesting that procurement delays and limited availability of critical spare parts remain challenges affecting railway maintenance operations. Conversely, respondents expressed agreement that supply chain processes were effective (M = 4.12, SD = 1.019) and that inventory management practices adequately maintained stock levels (M = 4.26, SD = 0.948). Furthermore, respondents strongly agreed that spare parts availability contributes to improved train service delivery efficiency (M = 4.61, SD = 0.708). These findings are consistent with previous studies which established that effective spare parts management improves maintenance responsiveness, increases train availability, and reduces operational interruptions (Gao et al., 2024). Similarly, shortages of critical spare parts have been associated with extended equipment downtime, procurement delays, and reduced operational efficiency, highlighting the importance of maintaining adequate spare parts inventories (Keckeis et al., 2024). Furthermore, optimizing spare parts distribution and inventory management helps reduce downtime and improve rolling stock maintenance, thereby enhancing operational performance and service reliability (Baigozhina et al., 2025).

5.3 effect of budget allocation adequacy on train service delivery efficiency.

The findings revealed that respondents generally disagreed that sufficient funding was available for the procurement of spare parts (M = 2.15, SD = 1.278), that maintenance budgets were released on time (M = 2.23, SD = 1.313), that maintenance funds were sufficient (M = 2.27, SD = 1.354), and that financial support for maintenance activities was reliable (M = 2.30, SD = 1.355). These results suggest that financial constraints remain a challenge to the timely implementation of railway maintenance activities and may affect train service delivery efficiency. The findings are consistent with previous studies which established that adequate financial resources for maintenance and infrastructure replacement contribute to improved infrastructure conditions and operational reliability, while inadequate funding may lead to deferred maintenance, infrastructure deterioration, and reduced service efficiency (Lampe et al., 2023). Similarly, efficient utilization of financial resources has been associated with improved railway operational efficiency and infrastructure performance, as adequate funding enables railway organisations to maintain their assets and provide reliable transport services (Kalem et al., 2024). In the African context, the findings are also supported by research conducted in South Africa, which highlighted that limited financial resources constrain the adoption of modern maintenance technologies, contribute to maintenance backlogs, and undermine infrastructure reliability and operational efficiency (Nethamba & Grobbelaar, 2023).

6.0 Conclusion and Recommendation

The study concludes that train service delivery efficiency along the Dar es Salaam–Dodoma SGR corridor is significantly associated with railway maintenance practices, spare parts availability, and budget allocation adequacy. The findings highlight the importance of regular preventive maintenance, timely procurement and availability of critical spare parts, and adequate and reliable maintenance funding in improving train reliability, reducing operational disruptions, and enhancing overall service delivery efficiency. Therefore, Tanzania Railways Corporation (TRC), policymakers, and other relevant stakeholders should strengthen maintenance practices, improve spare parts procurement and inventory management, and ensure adequate and timely allocation of financial resources to support maintenance activities and sustain efficient railway operations.

Area for Further Research, Since this study focused specifically on the Dar es Salaam–Dodoma SGR corridor, future research could extend the scope to other railway corridors and railway systems in Tanzania to determine whether similar relationships exist between maintenance practices, spare parts availability, budget allocation adequacy, and train service delivery efficiency across different operational contexts. Further studies could also. incorporate a qualitative approach to explore the underlying factors contributing to maintenance challenges, delays in spare parts procurement, inadequate or delayed budget allocation, and their effects on train reliability, punctuality, and overall service delivery efficiency.

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