ADAPTABILITY EFFECT ON TANZANIA PORTS' COLLABORATION AND CONGESTION

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ABSTRACT

Purpose: This study examined the moderating effect of adaptability on the relationship between team collaboration in port facilities and equipment maintenance, and its impact on truck congestion, based on the experience from Tanzania ports.

Methodology: Structured questionnaires were administered to 325 port stakeholders, with 334 respondents selected from a population of 2,536 agents using simple random sampling from three ports. Hypothesis testing was conducted using Structural Equation Modelling with SmartPLS and SPSS. The study followed a positivist philosophy and deductive approach, utilising an explanatory design and quantitative method. Schein's Theory and Queueing Theory were used to examine the interactions of three constructs, as no existing research model was addressing them.

Findings: The results revealed that team collaboration in port facilities and equipment maintenance has a significant positive impact on truck congestion. In contrast, the moderated link between adaptability and the outcome has a significantly positive effect. Further, the findings of the Importance-Performance Matrix Analysis revealed that team collaboration has the highest levels of both importance and performance in predicting the truck congestion in ports. The study concludes with strong confirmation that team collaboration positively influences truck congestion and expands the ST and QT dimensions.

Practical Implications: The results highlight aspects that the Tanzania Ports Authority and other Stakeholders can improve to eliminate truck congestion and facilitate logistics, thereby enhancing supply chain performance. The study's findings have significant implications for relevant policies and laws, including the National Transport and Trade Policy of 2003, the Ports Act 2004, and Agenda 2063: The Africa We Want.

Originality/value: This research identified dimensions of team collaboration in port facilities and equipment maintenance and examined how adaptability moderates its impact on truck congestion.

Keywords: Collaboration, logistics facilitation, adaptability, truck congestion, and supply chain performance.

Introduction

Organisational culture encompasses the morals and values of its members. Work discipline facilitates communication, whereas motivation reflects attitudes and values that affect employee performance (Aprilia et al., 2025). Inspired and comfortable employees engage fully, collaborate effectively, and consistently deliver excellence (Abid, 2024). Moreover, organisational culture shapes employee behaviour, attitude, performance, and an organisation's ability to adapt to change and thrive in dynamic environments (Deresso et al., 2024). Organisational culture offers insights into strategies that foster adaptability within an organisation. The impact of organisational culture on employee performance has gained significant attention from researchers and practitioners. It distinguishes organisations, even within the same industry and environment (Deresso et al., 2024). Organisational culture is a system of shared meaning that sets an organisation apart and is crucial for corporate success. It is defined by seven key characteristics: innovation and risk-taking, attention to detail, outcome orientation, people orientation, team orientation, team collaboration, and stability, according to Dennis et al.(2024).

Consequently, understanding the dynamic relationship between team collaboration and performance has become essential for fostering an environment where employees can thrive, adapt, and contribute effectively to the organisation's success (Deresso et al., 2024). Seaports operate as groups focused on achieving organisational goals, with employees playing a vital role as representatives of stakeholders. One major challenge faced by seaports is truck congestion at terminal gates, exacerbated by rising trade volumes and the influx of container trucks. This issue highlights the need for a better understanding of truck arrivals in relation to gate capacity. According to UNCTAD's 2023 reports, global port container throughput volume increased (Atonga et al., 2024; Li et al., 2024; Chuchottaworn & Raothachonkun, 2024). According

to the UNCTAD (2023) report, global port container throughput rose from 780 million TEUs in 2018 to 852 million TEUs in 2022, with an annual increase of 14.4 million TEUs. In Tanzania, throughput grew slightly from 0.705 million TEUs in 2018 to 0.707 million TEUs in 2022, averaging 400 TEUs annually. The Port of Dar es Salaam is strategically important as it serves as a crucial gateway for landlocked countries like Burundi, DRC, Malawi, Rwanda, Uganda, and Zambia, facilitating trade and economic development. Currently, over 90 per cent of cargo to these countries is transported by road, with 10 per cent by railway (LATRA, 2024).

The challenges of organisational culture, increasing urban transport demands, and potential container growth underscore the need for a thorough examination. This study focuses on team collaboration, adaptability, and truck congestion, which are vital for informed decision-making to retain and attract customers at Tanzanian ports. The primary objective is to explore how adaptability affects the relationship between maintenance team collaboration and truck congestion at these ports. The findings on the study variables improved local knowledge and understanding. An Important-Performance Map Analysis (IPMA) for Tanzania's ports was developed based on these findings for management consideration. This study, thus, aimed to examine the Ports Act 2004 No 17 on port promotion and the mission spelt out in the National Transport Policy of 2003 (Tanzania, 2003) and the 2023 National Trade Policy for a Competitive Economy's vision, and Agenda 2063: The Africa We Want, vis-à-vis the country's port operations.

Literature Review

Theoretical Literature Review

To address its objectives, the study was informed by Schein's and Queueing Theory:

Schein's Theory of Organisational Culture (ST)

Schein's theory of organisational culture, founded by Edgar Schein in 1985, describes culture as a pattern of shared basic assumptions developed to solve problems of internal cohesion, collaboration, and external adaptation, among other characteristics of organisational culture, which then becomes a framework for how members perceive, think, and feel within the organisation (Schein, 1984, 1990). This theory provides insights into how organisations internalise cultural values as employees navigate a landscape filled with varying changes, which they acquire through adaptability (Gloria & Odion, 2024; Schein, 1990). Muhyi and Raharja (2017) applied ST in their study to confirm that companies must improve the employees' collaboration in performing their work to achieve their targets.

The Queueing Theory

The Queuing theory (QT), established by Agner Krarup Erlang in 1909, is a mathematical framework that models and predicts the behaviour of systems handling random demands, focusing on arrival patterns and their impact on congestion (Varghese et al., 2021). Ekeocha and Ihebom (2018) conducted a study on truck congestion with the QT application and supplied insights that might have promoted smooth traffic flow, depending on traffic intensity in some areas of Victoria Island, Lagos, Nigeria. Zhang et al. (2013) applied the QT to study existing truck congestion at port terminals and proposed a truck appointment system for its alleviation. Raharjo et al. (2024) also examined factors contributing to congestion at Gilimanuk port, Indonesia, particularly focusing on time losses for stakeholders. It defines team collaboration as the independent variable, with adaptability as a moderating variable. The ST theory supports this framework, while truck congestion is the dependent variable, operationalised by the QT.

Empirical Literature Review

Team collaboration in port facilities, equipment maintenance, and truck congestion

Global challenges now demand diverse perspectives and skills that can only be achieved through teamwork (Xunan et al., 2024). Team collaboration is essential in providing high-quality support and services while maximising competence. The willingness of staff members to form team collaboration fosters a safe working environment for healthcare professionals (Kida et al., 2024). Team collaboration addresses challenges in

future freight transportation by optimising vehicle fleets for increased efficiency (Liang et al., 2016). These reviews led researchers to explore how team collaboration affects the maintenance of port facilities and equipment, and its impact on truck congestion. Thus, the study hypothesises:

H_1: Team collaboration in port facilities and equipment maintenance has a positive influence on truck congestion.

Adaptability, team collaboration and truck congestion

Adaptability is crucial in today's rapid business environment, enabling organisations to stay competitive, enhance performance, and encourage aligned behaviour (Khumhome & Tassawa, 2024). Organisational culture, which includes team collaboration, plays a crucial role in effective adaptability to change (Al-Azkiya et al., 2024). Therefore, we hypothesize:

H_2: Adaptability moderates the relationship between team collaboration in port facilities and equipment and truck congestion.

Methodology

Adaptability is vital in today's fast-changing business environment, helping organisations stay competitive, improve performance, and encourage goal-oriented behaviour (Saunders, 2019; Antwi & Kasim, 2015). Moreover, the study applied the quantitative method to collect numerical data and analyse it using statistical methods to test hypotheses, identify patterns, and make predictions (Saunders, 2019). It supported what is embedded in the positivism paradigm that focused on fresh data collection following the problem from a large population, and analysis of data (Saunders, 2019). The quantitative method works on objective measures, which are assessed through actions and opinions, helping the researcher describe the data rather than interpret it. Indeed, it integrates purposes and procedures that are deductive, objective, and generalised (Morgan, 2014). A deductive approach was utilised as theories were being tested by investigating relationships among variables that start with general and end with specific, whereas inductive research focuses on the application of a qualitative approach and moves from specific to general (Creswell, 2014; Trochim et al., 2016).

Sample Selection, Unit of Analysis, and Inquiry

The study concentrated on the ports of Dar es Salaam, Mtwara, and Tanga, highlighting their variations in truck congestion, team collaboration, and operational adaptability. A sampling frame is a comprehensive list of items or units from which a sample is selected for the study (Quinlan et al., 2015). In this study, the study population comprised two groups: Port Stakeholders (i.e., Importers, Exporters, Transporters, CF & Shipping Agents), and the Tanzania Ports Authority (i.e., TPA Engineers, Operators, Supervisors, HR Managers & Officers), which interact on daily basis in maintaining port equipment and facilities in cargo handling, which affects truck congestion, hence a study population of 2,536. Using Krejcie and Morgan (1970) formula, which had already been applied by Januszyk *et al*. (2011) and Minani (2019) to estimate the representative sample size, the study projected a sample size of 334 port customers; however, we subsequently gathered data from 325 respondents, generated through simple random sampling. The study's unit of analysis was the CF & S Agency Companies (the employer), and the units of inquiry were the staff members (employees) of the firm who had adequate information about port services.

Measurement and Operationalisation of Variables

The study involved two variables: Truck Congestion (TR) and Team Collaboration (TE), with Adaptability (AD) serving as a moderating variable.

Team Collaboration

The process of two or more people, entities, or organisations working together to complete a task, achieve a goal, or create a value while sharing virtual or physical space (Rosen, 2007).

Truck congestion

The truck remains stationary for a long time due to excessive traffic on the roadway to and from the port, resulting in significantly slower speeds (Abdelgadir & Ahmed, 2025).

Adaptability

This refers to an individual's willingness and ability to stay flexible, resourceful, and proactive when facing environmental changes (Deresso et al., 2024), and to adjust to new conditions or situations, embodying resilience and openness to change (Chu et al., 2024).

Data Analysis, Interpretation and Discussion of Findings

Respondent's Profile

The study received 325 questionnaires from the ports, resulting in a response rate of 97.31%. The sample was 85.2% male and 14.8% female, with an average age of 35.5 years. Educational backgrounds included 38.5% with university degrees, 32.9% with college certificates, 22.5% with secondary school certificates, 5.5% with non-formal education, and 0.62% with primary education. The average working experience among respondents was 15 years.

The Measurement Model

Using composite reliability, Cronbach's alpha, rho_A, AVE, and HTMT, the measurement model produced the following results:

	Composite Reliability (>0.7)	**Cronbach Alpha** (>0.7)	**rho_A**	**Average Variance Extracted** (>0.5)	**HTMT** (HTMT < 1)		**Decision**
					AD	**TE**	
AD	0.872	0.804	0.822	0.631			Good
TE	0.906	0.868	0.883	0.659	$0.955CI_{0.95}$ [0.836;0.983]		Good
TR	0.935	0.919	0.921	0.673	$0.985CI_{0.95}$ [0.768;0.998]	$0.904CI_{0.95}$ [0.852;0.973]	Good

Table 1: Measures of Construct Validity and Reliability; **Source:** Field Data (2025)

The results in Table 2 demonstrate that exogenous latent variables possess reasonable measures of validity and reliability across all variables, including the endogenous variable, TR.

Common Method Bias

Subjected to a simple Collinearity Test using VIF, CMV results indicate that all the constructs had variance-inflated factor (VIF) values of less than the proposed threshold of 5. When VIF values are higher, the level of correlation or collinearity is greater. VIF values of 5 or above indicate collinearity problems (Hair et al., 2014). Hence, CMV posed no threat.

The Model's Predictive Power ($PLS_{Predict}$) (out-of-sample)

The assessment of the model's predictive power found the RMSE of LM (i.e., prediction) to be greater than that of PLS-SEM (i.e., actual) in TR1, TR2, TR3, and TR4, implying a lower prediction error. Moreover, the values of Q^2_predict for the four indicators of the endogenous variable are all above 0, ranging from 0.353 to 0.480, indicating a lower prediction error. As a result, the model exhibits higher predictive power.

Direct and Final Measurement Models

Figures 1 and 2 indicate the direct and final measurement models, respectively, with the indicator loadings satisfying the criterion:

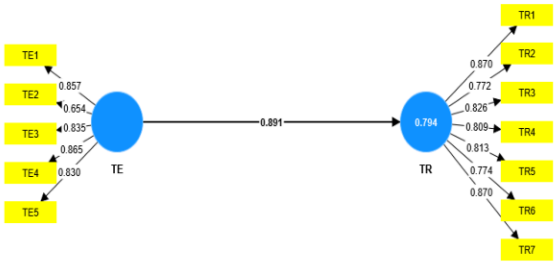


Figure 1: Direct Measurement Model.

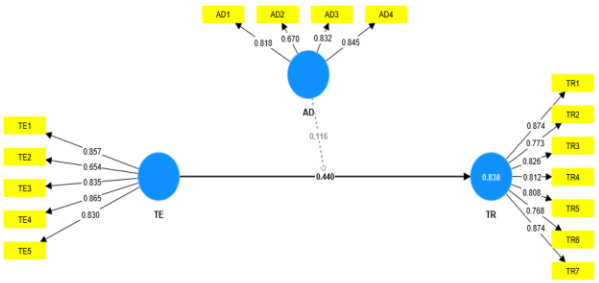


Figure 2: Moderated Measurement Model.

Evaluation Results of the Structural Model

Janadari et al. (2016) state the consistent conceptually and theoretically defined relationship between context and observables, both the input and output sides of the data are represented by the structural model and its latent variables. In the evaluation of the model of the structure, Hair et al. (2021) suggested five-step processes as follows: collinearity in the structural model should be evaluated, together with the path coefficient, level of R^2, the effect size of f^2, and predictive value of Q^2.

Both independent variables have a VIF value of 1.336, indicating no collinearity issues. The path coefficient of 0.891 shows a strong positive relationship, meaning a one standard deviation increase in the TE construct results in a 0.891 standard deviation increase in TR, while holding other constructs constant. The R^2 value of 0.794 indicates that the exogenous construct explains 79.4% of the variance in TR. The effect size (f^2) of 3.858 suggests a significant effect, and the predictive relevance (Q^2) is 0.509, confirming the model's predictive relevance.

Model Assessment

The structural model results reveal a significant relationship between TE and TR. In this regard, the measuring of the direct model, with the coefficient of determination of the R^2 value standing at 0.794, implies that a 79.4% change in TR can be accounted for by two (2) exogenous constructs as follows:

Direct effect of team collaboration in port equipment and facilities on truck congestion

The first hypothesis, H_1, states that team collaboration has a positive bearing on truck congestion. In testing the hypothesis, the results indicate that TE has a significant impact on TR (β = 0.891, t = 51.823, p = 0.000), i.e. a unit increase of TE increases TR by a path coefficient of 89.1%, *ceteris paribus* (Hair et al., 2017). Also, the confidence intervals [0.855; 0.921] do not include 0, indicating the existence of a direct effect (Hair et al., 2017). Moreover, the t-value of 51.823 is above the critical value for the z-test of 1.645. Therefore, H_1 was supported and, hence, validated.

Moderation Analysis Results

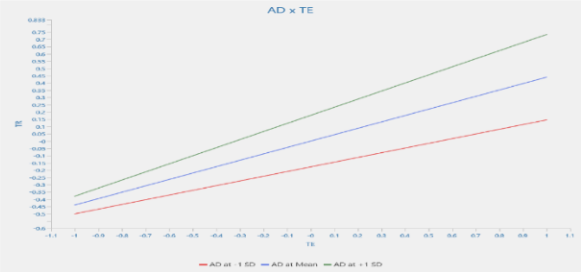
The moderated model was also measured, and the coefficient of determination of the R^2 value has improved from 0.794 to 0.838, hence an 83.8% change in TR for two (2) exogenous constructs. Moreover, the effect size of f2 was reduced to 0.154, corresponding to a negligible effect on R^2.

Adaptability and team collaboration in port equipment and facilities to truck congestion

The second hypothesis, H_2, states that the higher (lower) the adaptability, the weaker (stronger) the influence of team collaboration on truck congestion. The results indicate that AD*TE has a significant impact on TR (β = 0.116, t = 4.158, p = 0.000). Implicitly, suppose one unit increases (or decreases) in adaptability. In that case, the influence of team collaboration and truck congestion increases (decreases) by the size of the path coefficient (11.6%), *ceteris paribus* (Hair et al., 2017). The t-value drops from 51.823 to 4.158, but still exceeds the critical z-test threshold of 1.645, thus validating H_2.

Simple Slope Analysis

A typical moderator analysis results in representation using simple slope plots (Hair et al., 2021). This study features a slope plot, as illustrated in Figure 3:



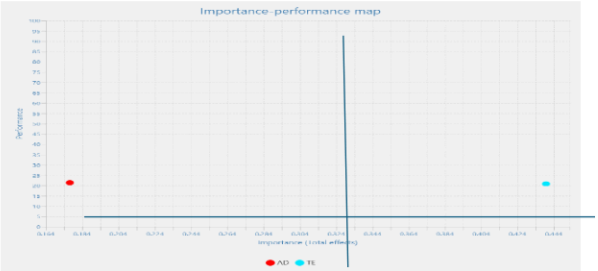


Figure 3: Moderated Effect of Simple Slope Analysis. **Figure 4:** Importance–Performance Map Analysis.

Moderation Effect of Simple Slope Analysis between AD, TE, and TR

The relationship between TE and TR is positive. Hence, lower levels of TE are associated with lower levels of TR. At the first phase of the graph (TE>0), the upper line (in red), which represents a lower level of the moderator, AD, with a standard deviation below the mean, has a flatter slope, hence representing a more substantial positive effect. Moreover, the bottom line (in green), which represents a higher level of moderator, AD with a standard deviation above the mean, has a steeper slope, indicating a weaker positive effect. The simple slope plot shows that the favourable interaction terms that enhance AD levels entail a slightly stronger relationship between TE and TR and vice versa, which is accepted.

Importance-Performance Map Analysis (IPMA)

Ringle and Sarstedt (2016) contend that multiple moderators in a total or moderated effect complicate the interpretation of IMPA's importance dimension. As such, it is advisable to exclude moderators in an IPMA (Hair et al., 2017; Ringle & Sarstedt, 2016). The findings confirm that TE, the exogenous variable, is in Quadrant IV, with 'Possible Overkill' Restrain status, which translates to close coordination among port authorities and operators, along with established and maintained relationships with vendors. However, port stakeholders attach only slight importance to them, whereas AD is in Quadrant I with 'Concentrate Here', Focus efforts, Improve immediately translates that Port stakeholders feel that low port tariffs are significant, but would contract financial capacity for port performance improvement to alleviate truck congestion (Martilla & James, 1977),

Conclusion, Implications, and Recommendations

Effect of team collaboration on the truck congestion

By confirming that team collaboration has a positive influence on truck congestion, the study findings support hypothesis $\mathbf{H_1}$. The findings provide empirical support for the ST and QT by showing that team collaboration is significant and positively related to truck congestion. These findings align with those of Kida et al. (2024), Liang et al. (2016), and Xunan et al. (2024). To enhance team collaboration, port authorities and operators must improve coordination with engineering regulations, establish and maintain vendor relationships for strategic procurement, investigate and report equipment-related incidents to prevent recurrence, review engineering requests with user departments to ensure timely delivery, and share knowledge and resources during the maintenance of port equipment and facilities.

The Moderating Effect of adaptability on team collaboration on the truck congestion

Second, the study's findings support hypothesis $\mathbf{H_2}$, which posits that adaptability moderates the relationship between team collaboration and truck congestion. The findings of this study align with those of Al-Azkiya et al. (2024), Cai et al. (2024), Khumhome and Tassawa (2024), and Kumasey et al. (2024). The findings in this study are also coherent with the truck congestion findings of Abdelgadir and Ahmed (2025), Bernacki and Lis (2021), and Chuchottaworn and Raothachonkun (2024). The study found that all measurements of adaptability were reliable and valid, emphasising the need for a culture of flexibility,

empathy, continuous learning, innovation, and resilience in maintaining port equipment. To enhance supply chain performance, strategies to alleviate truck congestion should include: i) real-time data availability for timely cargo collection and drop-off to reduce pollution and economic loss, and ii) collaboration among truck owners, terminal operators, and other stakeholders through methods such as Carpooling, Collaborative Logistics Networks (CLN), Vessel Dependent Time Windows (VDTW), Vehicle Routing Problem with Backhauls, Drayage and Truck Appointment Systems (TAS), and much more (Essi et al., 2022).

Implications

This study has explored the link between team collaboration, adaptability, and truck congestion—an area with limited prior research. The results reinforce the theoretical understanding of these factors, providing valuable insights for both researchers and practitioners. TPA Management should focus on effective coordination among port authorities and operators and adopt strategies to reduce truck congestion. Actions such as maintaining vendor relationships, investigating incidents, reviewing engineering requests, and sharing resources collaboratively are crucial. Additionally, staff should emphasise flexibility, resilience, innovation, and ongoing learning in port management. The TPA Ports Act 2004 aims to enhance efficient seaport operations and maritime services. While the study highlights the role of TE in decreasing truck congestion, it also urges policymakers to reassess human resource policies to better leverage team collaboration, which is currently underemphasized in the act's objectives.

Recommendations for future studies

This study highlights adaptability and team collaboration as key factors in reducing truck congestion at TPA. Future research should explore additional cultural and non-cultural attributes and collaborate with international ports to gain comparative insights.

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