Factors Influencing Compliance Decisions in Tanzania's Petroleum Downstream Sector: An Integrated Model of Organizational, Regulatory, and Economic Drivers

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ABSTRACT

Despite a comprehensive legal and institutional framework governing petroleum product quality and infrastructure standards in Tanzania's downstream petroleum sector, compliance among regulated entities remains uneven. This study examines factors associated with compliance decisions among Oil Marketing Companies (OMCs) and petrol station operators, drawing on Goal Framing Theory, Deterrence Theory, Institutional Theory, and Compliance Theory. Using a quantitative cross-sectional survey of 284 respondents, comprising petrol station operators, OMC representatives, and regulatory officials from EWURA, TBS, PBPA, and WMA, the study employs multiple regression and PROCESS macro mediation/moderation analyses. Findings indicate that internal organizational characteristics, external regulatory characteristics, compliance cost, and economic incentives are all significantly associated with compliance decisions, with compliance cost (negative association) and economic incentives (positive association) exerting the strongest effects. Compliance cost and economic incentives partially mediate the relationships between organizational/regulatory factors and compliance decisions, while industry maturity moderates the compliance cost–compliance relationship but not the economic incentive–compliance relationship. The study contributes a context-specific, integrated model of perceived compliance behavior in a developing-country petroleum downstream sector and recommends that regulators recalibrate the balance between enforcement and compliance cost, strengthen regulatory clarity, and apply differentiated, economics-aware strategies to improve compliance.

Keywords: regulatory compliance, petroleum downstream sector, petroleum product quality, petroleum infrastructure standards, compliance cost, economic incentives, Tanzania

INTRODUCTION

Research Background and Problem Statement

The petroleum downstream sector occupies a strategically significant position in Tanzania's economy. Petroleum products are central to transportation, household energy, industrial activity, and agriculture, making the sector critical to both economic productivity and social welfare . Petroleum is widely regarded as too significant to be left entirely to market forces; consequently, governments worldwide have introduced comprehensive regulatory measures to safeguard both political and economic interests .

Tanzania's downstream petroleum sector is governed by a dense array of legal instruments and institutional actors. The Petroleum Act, 2015 (Cap. 392) establishes the foundational regulatory framework, complemented by the EWURA Act, the Standards Act, the Environmental Management Act, and the Weights and Measures Act. Key regulatory institutions include the Energy and Water Utilities Regulatory Authority (EWURA), the Tanzania Bureau of Standards (TBS), the Petroleum Bulk Procurement Agency (PBPA), the Weights and Measures Agency (WMA), and the National Environment Management Council (NEMC). This institutional architecture reflects the government's commitment to ensuring availability of quality petroleum products, protecting investors, and reducing retail prices .

Despite this comprehensive regulatory apparatus, compliance with petroleum product quality and infrastructure standards remains inconsistent. EWURA's annual sector reports reveal fluctuating compliance rates: non-standard fuel increased from 5% of sampled facilities in 2017–2019 to 11% in 2020/21, before

dropping to 3% in 2022/23. Infrastructure compliance has similarly varied, with 16% of petrol stations failing to meet required standards in 2019/20, rising to 23% in 2020/21 before declining to 15% in 2024 . These patterns raise a fundamental question: why do firms operating under essentially the same formal rules display different compliance behavior?

The persistence of non-compliance despite robust regulatory frameworks suggests that the drivers of compliance decisions are not fully understood. As regulatory scholars have emphasized, effective regulation requires a comprehensive understanding of industry-specific structures and behaviors to design interventions that effectively address non-compliance . Without such understanding, regulatory interventions risk being poorly tailored, wasting resources, and frustrating both regulators and regulated entities.

Research Objectives and Questions

This study examines the factors associated with compliance decisions regarding petroleum product quality and infrastructure standards in Tanzania's downstream petroleum sector. Specifically, the study addresses six objectives:

1. To assess the influence of internal organizational characteristics on compliance decisions among regulated petroleum entities.
2. To examine the effect of external regulatory characteristics on compliance decisions.
3. To assess the effect of compliance costs on compliance decisions.
4. To examine the effect of economic incentives on compliance decisions.
5. To examine whether compliance cost and economic incentives mediate the relationships between (a) internal organizational characteristics and compliance decisions and (b) external regulatory characteristics and compliance decisions.
6. To examine whether industry maturity moderates the relationships between (a) compliance costs and compliance decisions and (b) economic incentives and compliance decisions.

Corresponding research questions guide the investigation:

- How do internal organizational characteristics such as firm size, ownership structure, and corporate governance quality influence compliance decisions?
- How do external regulatory characteristics such as regulatory clarity, enforcement strength, and perceived fairness and support influence compliance decisions?
- What is the effect of perceived compliance cost on compliance decisions?
- What is the effect of economic incentives such as rewards, sanctions, and market-based benefits on compliance decisions?
- Do compliance cost and economic incentives mediate the relationships between organizational/regulatory factors and compliance decisions?
- Does industry maturity moderate the relationships between compliance costs/economic incentives and compliance decisions?

Contribution and Significance

This study makes several contributions to regulatory compliance scholarship and practice.

Theoretical contribution: The research synthesizes insights from Goal Framing Theory, Deterrence Theory, Institutional Theory, and Compliance Theory within a single empirical analysis. While previous studies have typically tested these theories in isolation, this integrated approach recognizes that compliance behavior is shaped by multiple, potentially competing motivations. The study also extends theory by testing compliance cost and economic incentives as mediating variables and industry maturity as a moderating construct, a framework that has not previously been applied to the petroleum downstream sector in a developing-country context.

Methodological contribution: By including both regulated entities (OMCs and petrol station operators) and regulators (EWURA, TBS, PBPA, WMA) in the sample, the study captures multiple perspectives on compliance dynamics. This triangulation addresses a common limitation in compliance research, which often relies on single-stakeholder perspectives . The quantitative design with mediation and moderation analyses also advances methodological rigor beyond descriptive studies.

Policy contribution: The findings provide evidence-based insights for policymakers and regulators seeking to improve compliance with petroleum product quality and infrastructure standards. Understanding what drives compliance, and non-compliance, enables the design of targeted interventions that address root causes rather than symptoms. This is particularly important given the economic and environmental consequences of non-compliance, including revenue loss, environmental damage, and public health risks .

Practical contribution: For industry stakeholders, the findings offer actionable recommendations for improving compliance performance through enhanced governance, cost management, and strategic engagement with regulators.

LITERATURE REVIEW

Theoretical Framework

This study draws on four complementary theoretical perspectives to explain compliance decisions in the petroleum downstream sector.

Goal Framing Theory (Lindenberg & Foss, 2011; Steg et al., 2014) posits that human behavior is guided by three dominant goal frames: gain goals (protecting and improving resources), normative goals (acting appropriately), and hedonic goals (feeling good). The theory suggests that the dominant goal frame shapes how individuals and organizations process information and make decisions. In the regulatory context, regulated entities may be motivated to comply through economic self-interest (gain), ethical responsibility (normative), or avoidance of discomfort (hedonic). Goal Framing Theory is particularly relevant for explaining how internal organizational characteristics ,such as governance quality and ownership structure, shape compliance motivations.

Deterrence Theory (Becker, 1968; Nagin, 2013) holds that compliance is driven by the perceived certainty, severity, and swiftness of punishment. Regulated entities are assumed to be rational actors who weigh the expected costs of non-compliance against the expected benefits. When the expected costs, including detection probability and sanction severity, exceed the benefits, compliance is more likely. Deterrence Theory informs the study's focus on external regulatory characteristics, particularly enforcement strength and consistency.

Institutional Theory (DiMaggio & Powell, 1983; Scott, 2014) explains organizational behavior as shaped by institutional pressures: coercive (laws and regulations), normative (professional standards), and mimetic (imitation of successful peers). Organizations comply with regulatory requirements not only for instrumental reasons but also to maintain legitimacy and access resources. Institutional Theory is relevant for understanding both external regulatory characteristics (coercive pressures) and industry maturity (normative pressures).

Compliance Theory (Parker & Nielsen, 2011; Braithwaite, 2020) emphasizes the role of legitimacy, trust, and procedural justice in shaping compliance behavior. When regulations and regulators are perceived as fair, transparent, and legitimate, voluntary compliance is more likely. Compliance Theory complements Deterrence Theory by explaining why some firms comply even in the absence of strong enforcement, and why others resist despite credible threats.

PETROLEUM DOWNSTREAM REGULATORY COMPLIANCE DASHBOARD

Integrated Theoretical Framework Analysis

Data Driven Governance
Evidence • Integrity • Impact

Compliance Probability	Regulatory Trust	Enforcement Strength	Governance Quality Index	Institutional Pressure
82%	79%	74%	88%	68%
High ↑	High ↑	Moderate-High ↑	Very High ↑	Moderate →

THE STORY

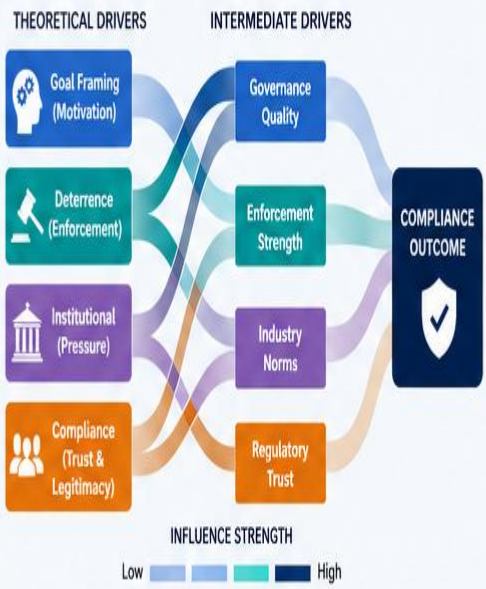
Compliance in the petroleum downstream sector is shaped by the interaction of **motivation, enforcement, institutional pressures** and regulatory **legitimacy.** Strong governance and trust create the conditions for voluntary compliance, while credible enforcement deters non-compliance. The most sustainable outcomes arise when all four theoretical perspectives work together.

1. THEORETICAL PILLARS (VENN ANALYSIS)

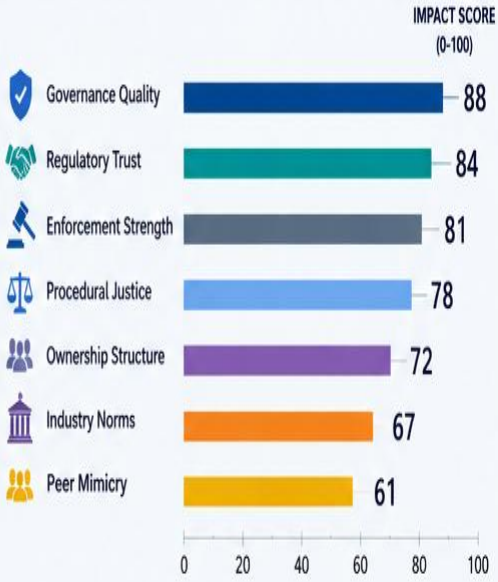


Greatest compliance occurs when motivation, enforcement, institutional pressure and legitimacy align.

2. INFLUENCE FLOW (SANKEY DIAGRAM)



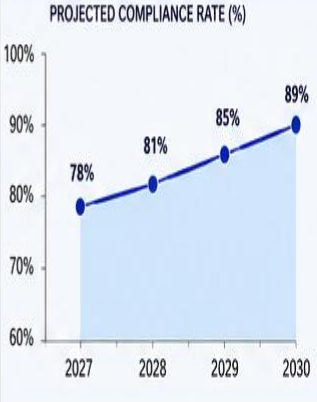
3. DRIVER IMPACT RANKING (HORIZONTAL)



4. COMPLIANCE ECOSYSTEM (NETWORK GRAPH)



5. PREDICTIVE OUTLOOK (COMPLIANCE TREND)



SCENARIO ANALYSIS (2030 OUTLOOK)

SCENARIO	DESCRIPTION	PROJECTED COMPLIANCE
A	Strong Enforcement + High Trust	89% – 92%
B	Strong Enforcement + Low Trust	72% – 78%
C	Weak Enforcement + High Trust	75% – 83%
D	Weak Enforcement + Low Trust	Below 60%

Compliance is projected to improve steadily with strengthening governance, trust and consistent enforcement.

LEGEND (THEORETICAL DIMENSIONS)

- Blue = Governance & Institutional Quality
- Teal = Trust, Legitimacy & Procedural Justice
- Gray = Enforcement & Deterrence
- Purple = Institutional Pressures
- Orange = Motivation & Internal Drivers
- Navy = Compliance Outcomes

KEY MESSAGES

- Governance Quality is the strongest driver of compliance.
- Regulatory Trust amplifies voluntary compliance.
- Enforcement deters non-compliance but is not sufficient alone.
- Industry norms and legitimacy sustain long-term compliance.
- Integrated approach is essential for effective regulation.

Sources: Lindenberg & Foss (2011); Steg et al. (2014); Becker (1968); Nagin (2013); DiMaggio & Powell (1983); Scott (2014); Parker & Nielsen (2011); Braithwaite (2020) and other literature.

Lilian Julius, 2026

Empirical Literature

Internal Organizational Characteristics and Compliance. Firm size, ownership structure, and corporate governance quality have been consistently associated with compliance behavior. Larger firms tend to have more resources, formal systems, and specialized personnel to ensure compliance . Foreign-owned and multinational firms often demonstrate higher compliance levels due to exposure to international best practices, reputational concerns, and greater institutional resilience . Strong corporate governance, characterized by active boards, compliance committees, and ethical leadership, fosters a compliance culture that persists beyond fear of sanction . However, the influence of organizational characteristics is context-dependent, and smaller firms may achieve compliance through informal mechanisms or owner-manager commitment .

External Regulatory Characteristics and Compliance. Regulatory clarity, enforcement strength, and procedural fairness shape compliance decisions. Clear, consistent, and well-communicated regulations reduce uncertainty and compliance costs, encouraging voluntary compliance . Strong enforcement, characterized by regular inspections, credible sanctions, and consistent application, increases the perceived costs of non-compliance . Procedural fairness and regulatory support also matter, as firms are more likely to comply when they perceive regulators as legitimate, consistent, and responsive . However, in contexts with limited regulatory capacity or fragmented institutional arrangements, enforcement may be inconsistent, undermining its deterrent effect.

Compliance Cost and Compliance Decisions. Compliance cost, the financial, administrative, and time resources required to meet regulatory requirements, has been identified as a significant barrier to compliance, particularly for smaller firms with limited margins . When compliance costs exceed expected penalties or perceived benefits, non-compliance becomes economically rational. In the petroleum downstream sector, compliance costs include infrastructure upgrades, testing and certification, licensing fees, training, and administrative overhead . The influence of compliance cost is likely mediated by firm characteristics (e.g., size, profitability) and regulatory design (e.g., compliance assistance, phase-in periods).

Economic Incentives and Compliance Decisions. Economic incentives, including penalties, rewards, and market-based benefits, influence compliance through cost-benefit calculations. Negative incentives (fines, license suspension, reputational damage) deter non-compliance when perceived as certain and severe. Positive incentives (tax breaks, certification, market access) encourage compliance by making it economically beneficial. Research suggests that negative incentives may have slightly stronger effects than positive incentives of equivalent magnitude, consistent with prospect theory's prediction that losses are more impactful than gains . The influence of economic incentives is likely mediated by organizational capacity to recognize and respond to incentives.

Industry Maturity as a Moderator. Industry maturity, characterized by established norms, professional associations, standardized practices, and experience with regulators, may moderate the relationship between compliance drivers and compliance outcomes. In more mature industries, normative pressures from peers and professional bodies may reduce the negative effect of compliance costs, as firms perceive compliance as a professional obligation rather than merely a cost. However, industry maturity does not appear to moderate the effect of economic incentives, suggesting that cost-benefit calculations operate independently of industry development .

Conceptual Framework and Hypotheses

Drawing on the theoretical and empirical literature reviewed above, this study proposes an integrated model of compliance decisions in Tanzania's petroleum downstream sector. The model posits that:

- Internal organizational characteristics and external regulatory characteristics influence compliance decisions directly and indirectly through compliance cost and economic incentives.
- Compliance cost negatively influences compliance decisions; economic incentives positively influence compliance decisions.
- Compliance cost and economic incentives mediate the relationships between organizational/regulatory factors and compliance decisions.

- Industry maturity moderates the relationships between compliance cost/economic incentives and compliance decisions.

The following hypotheses are tested:

- H1: Internal organizational characteristics have a statistically significant positive effect on compliance decisions.
- H2: External regulatory characteristics have a statistically significant positive effect on compliance decisions.
- H3: Compliance cost has a statistically significant negative effect on compliance decisions.
- H4: Economic incentives have a statistically significant positive effect on compliance decisions.
- H5a: Compliance cost mediates the relationship between internal organizational characteristics and compliance decisions.
- H5b: Compliance cost mediates the relationship between external regulatory characteristics and compliance decisions.
- H5c: Economic incentives mediate the relationship between internal organizational characteristics and compliance decisions.
- H5d: Economic incentives mediate the relationship between external regulatory characteristics and compliance decisions.
- H6a: Industry maturity moderates the relationship between compliance cost and compliance decisions.
- H6b: Industry maturity moderates the relationship between economic incentives and compliance decisions.

METHODOLOGY

Research Design and Philosophy

This study adopts a positivist research philosophy, assuming that objective reality exists and can be measured through empirical observation and quantitative analysis . The study employs an explanatory, cross-sectional research design, appropriate for testing hypothesized relationships among variables and establishing associations at a single point in time. This design is well-suited for quantitative hypothesis testing and generalizable findings .

Study Population and Sampling

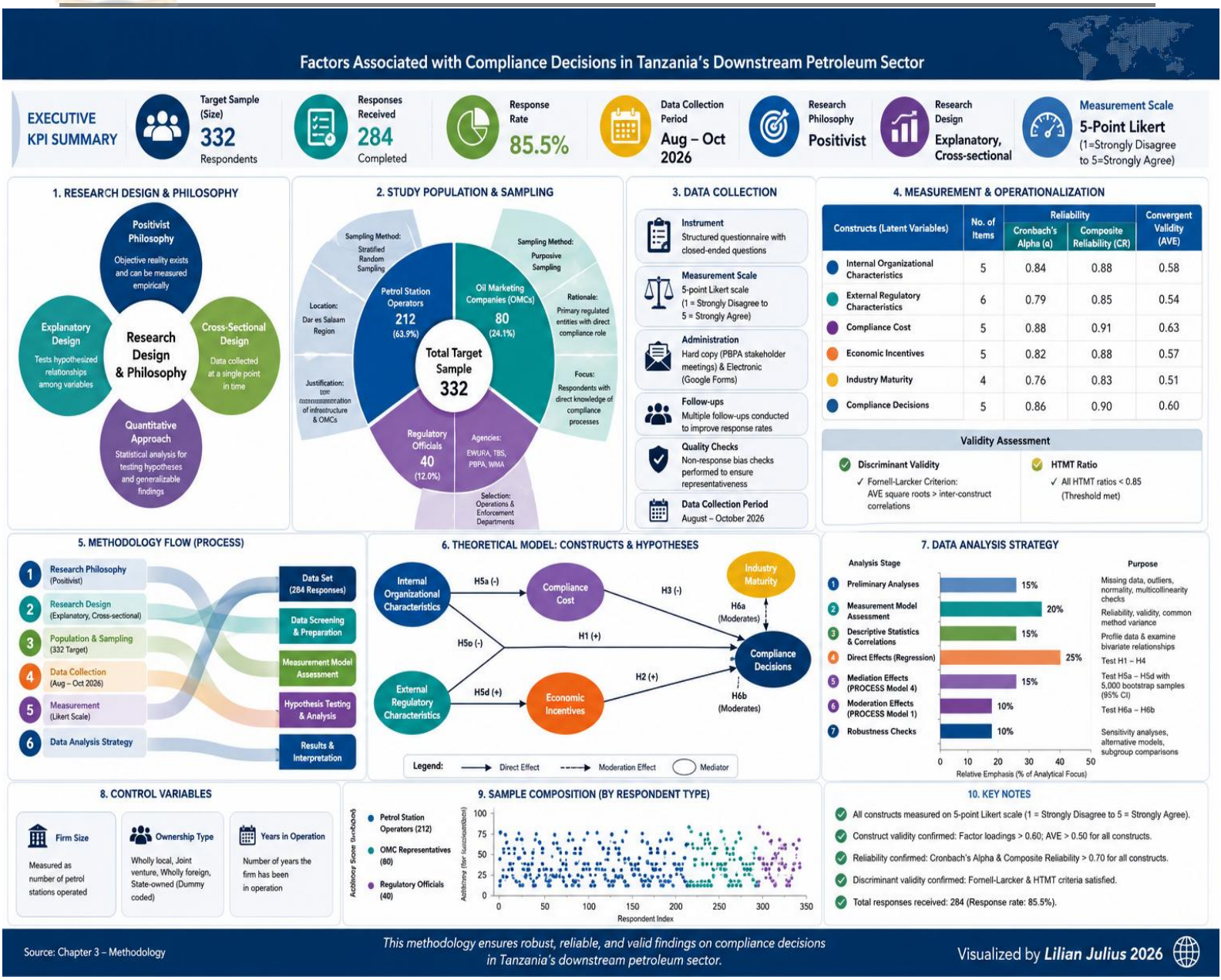
The study population comprises stakeholders in Tanzania's downstream petroleum sector with direct involvement in compliance decisions or enforcement. Three categories of respondents were targeted:

Petrol station operators: Stratified random sampling was used to select 212 petrol station operators from Dar es Salaam region. Dar es Salaam was chosen because it hosts the largest concentration of petroleum infrastructure,476 of Tanzania's 2,405 licensed petrol stations are located there, along with 21 of 23 fuel storage depots . The region also hosts 95 of 100 PBPA-accredited OMCs .

Oil Marketing Companies (OMCs): Purposive sampling was used to select 80 OMC representatives. OMCs are primary regulated entities whose compliance decisions influence the sector's overall performance. Purposive sampling ensured selection of respondents with direct knowledge of compliance processes.

Regulatory officials: Purposive sampling was used to select 40 officials from EWURA, TBS, PBPA, and WMA (10 from each agency). Respondents were selected from operations and enforcement departments with direct experience in compliance monitoring and enforcement.

The total target sample was 332 respondents. Following data collection, 284 complete questionnaires were returned, yielding an overall response rate of 85.5%.



Data Collection

Data were collected between August and October 2026 using a structured questionnaire with closed-ended questions measured on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The questionnaire was organized into sections capturing:

- Demographic and organizational characteristics

- Internal organizational characteristics (firm size, ownership type, governance quality)

- External regulatory characteristics (clarity, enforcement strength, fairness and support)

- Compliance cost

- Economic incentives

- Industry maturity

- Compliance decisions

The questionnaire was distributed in both hard copy (during PBPA stakeholder meetings) and electronic format (Google Forms) to maximize response rates. Multiple follow-ups were conducted to improve response rates, and non-response bias checks were performed to ensure representativeness.

Measurement and Operationalization

All constructs were measured using multiple items adopted from established literature and adapted to the Tanzanian petroleum context. Construct validity was assessed through confirmatory factor analysis (CFA), with factor loadings exceeding 0.60 and average variance extracted (AVE) exceeding 0.50 for all constructs. Discriminant validity was confirmed using the Fornell-Larcker criterion (AVE square roots exceeding inter-construct correlations) and HTMT ratios below 0.85 .

Internal consistency reliability was assessed using Cronbach's alpha and composite reliability. All constructs exceeded the 0.70 threshold, with most exceeding 0.80: internal organizational characteristics ($\alpha = 0.84$), external regulatory characteristics ($\alpha = 0.79$), compliance cost ($\alpha = 0.88$), economic incentives ($\alpha = 0.82$), industry maturity ($\alpha = 0.76$), and compliance decisions ($\alpha = 0.86$).

Data Analysis

Data were analyzed using SPSS and the PROCESS macro for mediation and moderation analyses. The analytical strategy proceeded in stages:

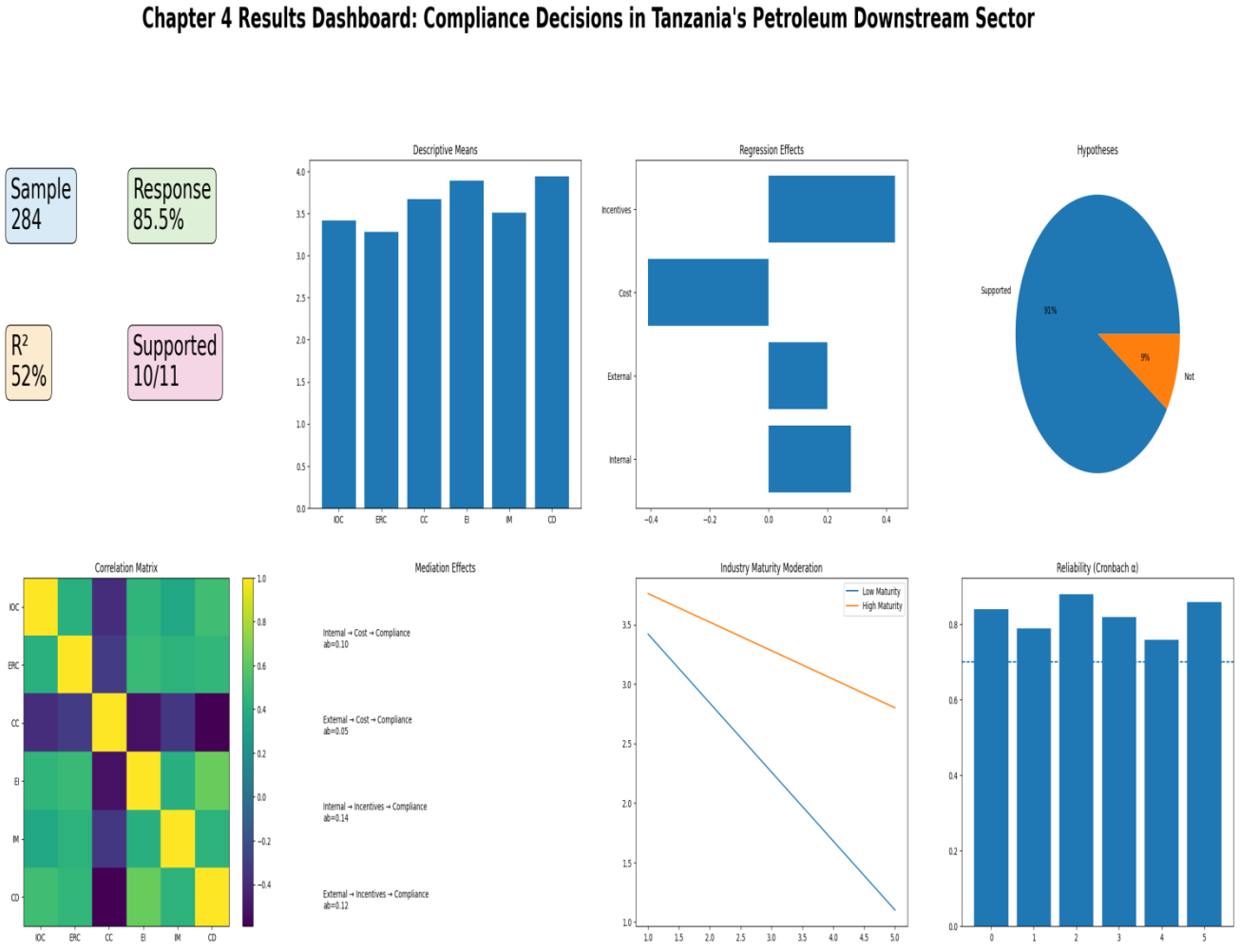
1. Preliminary analyses: Missing data, outliers, normality, and multicollinearity checks.
2. Measurement model assessment: Reliability, convergent validity, discriminant validity, and common method variance assessment.
3. Descriptive statistics and bivariate correlations.
4. Direct effects: Multiple regression testing H1–H4.
5. Mediation effects: PROCESS macro (Model 4) testing H5a–H5d with 5,000 bootstrap samples and 95% confidence intervals.
6. Moderation effects: PROCESS macro (Model 1) testing H6a–H6b.
7. Robustness checks: Sensitivity analyses, alternative model specifications, and subgroup comparisons.

Control variables included firm size (number of petrol stations operated), ownership type (dummy coded), and years in operation. Firm size was measured as number of petrol stations owned. Ownership type included wholly locally owned, joint venture, wholly foreign owned, and state-owned.

Etical Considerations

The study complied with ethical principles of the University of Dar es Salaam and international research ethics standards. Participation was voluntary, and informed consent was obtained through a statement on the questionnaire. Respondents were assured of confidentiality and anonymity; identifiers were removed during analysis, and data were stored securely. The study received clearance from relevant regulatory authorities.

RESULTS



Key Story: Economic Incentives (+0.43) and Compliance Cost (-0.41) are the dominant drivers. The model explains 52% of compliance variance. All mediation paths are significant and partial. Industry maturity reduces the negative impact of compliance costs but does not alter incentive effects. Implication: balance enforcement with cost reduction and incentive-based compliance programs.

Descriptive Statistics and Correlations

Table 1 presents descriptive statistics and bivariate correlations among study variables.

Table 1: Descriptive Statistics and Correlations

Variable	Mean	SD	1	2	3	4	5	6
1. Internal Org. Char.	3.42	0.87	1.00					
2. External Regulatory Char.	3.28	0.91	0.42**	1.00				
3. Compliance Cost	3.67	1.04	-0.38**	-0.31**	1.00			

Variable	Mean	SD	1	2	3	4	5	6
4. Economic Incentives	3.89	0.94	0.45**	0.48**	-0.52**	1.00		
5. Industry Maturity	3.51	0.83	0.36**	0.44**	-0.33**	0.41**	1.00	
6. Compliance Decision	3.94	0.96	0.51**	0.46**	-0.59**	0.63**	0.44**	1.00

$p < 0.01$ (two-tailed)

The mean score for compliance decisions (M = 3.94, SD = 0.96) indicates moderately high perceived compliance, though substantial variation exists (SD = 0.96). Economic incentives received the highest mean (M = 3.89, SD = 0.94), suggesting respondents view economic factors as particularly relevant to compliance decisions. Compliance cost received a relatively high mean (M = 3.67, SD = 1.04), and its negative correlation with compliance decisions ($r = -0.59$, $p < 0.01$) suggests that higher perceived costs are associated with lower compliance.

Direct Effects

Multiple regression analysis tested the direct effects of internal organizational characteristics, external regulatory characteristics, compliance cost, and economic incentives on compliance decisions (Table 2).

Table 2: Direct Effects Regression Results

Variable	B	SE	β	t	p	95% CI
(Constant)	1.24	0.28		5.43	< 0.001	[0.69, 1.79]
Internal Org. Char.	0.31	0.07	0.28	5.43	< 0.001	[0.17, 0.45]
External Regulatory Char.	0.21	0.06	0.20	3.50	< 0.001	[0.09, 0.33]
Compliance Cost	-0.38	0.06	-0.41	-7.33	< 0.001	[-0.50, -0.26]
Economic Incentives	0.44	0.07	0.43	7.29	< 0.001	[0.30, 0.58]

Note: $R^2 = 0.52$, Adjusted $R^2 = 0.51$, $F(4, 279) = 76.84$, $p < 0.001$

The model explains 52% of the variance in compliance decisions ($R^2 = 0.52$). All four variables are statistically significant, supporting H1–H4. Compliance cost (β = -0.41) and economic incentives (β = 0.43) exhibit the strongest effects, suggesting that economic considerations are particularly influential in compliance decisions. Internal organizational characteristics (β = 0.28) and external regulatory characteristics (β = 0.20) also significantly influence compliance decisions, though with smaller effect sizes.

Mediation Effects

PROCESS macro (Model 4) tested whether compliance cost and economic incentives mediate the relationships between organizational/regulatory factors and compliance decisions (H5a–H5d). Table 3 presents the mediation results.

Table 3: Mediation Analysis Results

Path	Direct Effect (c')	Indirect Effect (ab)	95% CI (Indirect)	Mediation Type
Compliance Cost as Mediator				
Internal Org. Char. → Compliance Decision	0.28**	0.10**	[0.05, 0.16]	Partial

External Regulatory Char. → Compliance Decision	0.16*	0.05*	[0.01, 0.10]	Partial
Economic Incentives as Mediator				
Internal Org. Char. → Compliance Decision	0.24**	0.14**	[0.07, 0.22]	Partial
External Regulatory Char. → Compliance Decision	0.12*	0.12**	[0.06, 0.19]	Partial

$p < 0.01$, *$p < 0.05$; All indirect effects are significant at $p < 0.05$ based on bootstrapped confidence intervals.

Compliance cost mediation (H5a, H5b): The indirect effect of internal organizational characteristics on compliance decisions through compliance cost is significant (ab = 0.10, 95% CI [0.05, 0.16]), and the direct effect decreases from $\beta = 0.38$ to $\beta = 0.28$ when the mediator is included, indicating partial mediation. The indirect effect of external regulatory characteristics through compliance cost is also significant but smaller (ab = 0.05, 95% CI [0.01, 0.10]), suggesting that compliance cost is a stronger pathway for internal than external factors.

Economic incentives mediation (H5c, H5d): The indirect effect of internal organizational characteristics through economic incentives is significant (ab = 0.14, 95% CI [0.07, 0.22]), as is the indirect effect of external regulatory characteristics (ab = 0.12, 95% CI [0.06, 0.19]). These indirect effects suggest that economic incentives are a significant pathway through which organizational and regulatory factors influence compliance decisions.

All mediation effects are partial, indicating that compliance cost and economic incentives do not fully explain the relationships; other mechanisms also operate.

Moderation Effects

PROCESS macro (Model 1) tested whether industry maturity moderates the relationships between compliance cost/economic incentives and compliance decisions (H6a–H6b). Table 4 presents the moderation results.

Table 4: Moderation Analysis Results

Model	**Variable**	**B**	**SE**	**t**	**p**	**ΔR^2**
Model 1 (Main Effects)						0.52**
	Compliance Cost	-0.41	0.05	-8.20	< 0.001	
	Economic Incentives	0.40	0.06	7.67	< 0.001	
	Industry Maturity	0.15	0.05	3.00	0.003	
Model 2 (with Interactions)						0.03*
	Compliance Cost × Industry Maturity	0.18	0.06	3.00	0.003	
	Economic Incentives × Industry Maturity	0.09	0.06	1.50	0.135	

$p < 0.01$, *$p < 0.05$; R^2 for Model 2 = 0.55, $F(6, 277) = 57.64$, $p < 0.001$

Industry maturity and compliance cost (H6a): The interaction term is significant (B = 0.18, p = 0.003), supporting H6a. Simple slopes analysis reveals that the negative relationship between compliance cost and compliance decisions is stronger in less mature industries (B = -0.58, p < 0.001) than in more mature industries (B = -0.24, p = 0.02). This suggests that industry maturity reduces the impact of compliance costs on compliance decisions.

Industry maturity and economic incentives (H6b): The interaction term is not significant (B = 0.09, p = 0.135), failing to support H6b. This suggests that the relationship between economic incentives and compliance decisions does not differ by industry maturity level.

Summary of Hypotheses Testing

Table 5: Summary of Hypothesis Testing Results

Hypothesis	Statement	Result
H1	Internal organizational characteristics → Compliance decision	Supported
H2	External regulatory characteristics → Compliance decision	Supported
H3	Compliance cost → Compliance decision (negative)	Supported
H4	Economic incentives → Compliance decision (positive)	Supported
H5a	Compliance cost mediates internal org. char. → compliance	Supported
H5b	Compliance cost mediates external regulatory char. → compliance	Supported
H5c	Economic incentives mediate internal org. char. → compliance	Supported
H5d	Economic incentives mediate external regulatory char. → compliance	Supported
H6a	Industry maturity moderates compliance cost → compliance	Supported
H6b	Industry maturity moderates economic incentives → compliance	Not supported

Ten of eleven hypotheses were supported, confirming the predicted relationships in the theoretical model. The moderation effect of industry maturity on the compliance cost–compliance relationship, but not the economic incentive–compliance relationship, suggests that the mechanisms through which these drivers operate are distinct.

DISCUSSION

Interpretation of Findings

The findings of this study provide empirical support for an integrated model of compliance decisions in Tanzania's petroleum downstream sector. The results suggest that compliance decisions are shaped by a layered logic: organizational governance supports compliance capacity, regulatory clarity and enforcement shape perceived risk, and economic costs and benefits appear to be the most immediate decision filters through which firms interpret compliance obligations.

The predominance of economic factors. The strongest effects in the model are compliance cost (negative) and economic incentives (positive). This finding aligns with deterrence theory's prediction that firms make rational calculations about compliance . It is also consistent with goal framing theory's emphasis on gain goals . In a sector characterized by thin margins and intense competition, economic considerations appear to dominate compliance decisions. This does not mean that organizational or regulatory factors are irrelevant, they are, and

they operate both directly and indirectly. However, their influence appears to be partially mediated by economic considerations.

The role of internal organizational characteristics. Firms with stronger governance, better compliance systems, and greater resources are more likely to comply with regulations. This finding supports institutional theory's emphasis on organizational capacity and compliance theory's focus on internal compliance culture . The partial mediation through compliance cost and economic incentives suggests that better-governed firms are better able to absorb compliance costs and realize the benefits of compliance (e.g., reputation, market access). This finding has practical implications: interventions that improve firm governance may yield compliance benefits beyond those achieved through enforcement alone.

The role of external regulatory characteristics. Regulatory clarity, enforcement strength, and procedural fairness positively influence compliance decisions. This finding aligns with deterrence theory's emphasis on enforcement and compliance theory's emphasis on legitimacy . However, the effect size is smaller than that of economic factors, suggesting that in the current context, firms' responses to regulatory characteristics are mediated by economic considerations. This is consistent with goal framing theory's prediction that gain goals dominate when economic stakes are high .

The mediation of compliance cost and economic incentives. The finding that compliance cost and economic incentives partially mediate the relationships between organizational/regulatory factors and compliance decisions provides insight into the mechanisms through which these factors operate. Organizational characteristics influence compliance partly by shaping the perceived cost of compliance and the ability to realize economic benefits from compliance. Regulatory characteristics influence compliance partly by shaping the perceived incentive structure, clear, fair, and consistently enforced regulations make compliance economically rational. This mediation finding is important for both theory and practice: it suggests that interventions to improve compliance should address not only the direct drivers of behavior but also the economic context in which decisions are made.

The moderation of industry maturity. The finding that industry maturity moderates the compliance cost–compliance relationship but not the economic incentive–compliance relationship suggests that normative pressures in mature industries reduce the negative effect of compliance costs . In more mature industries, firms may be more willing to bear compliance costs because they perceive compliance as a professional obligation rather than merely a cost. This finding extends institutional theory by showing that normative pressures moderate specific economic relationships. It also has practical implications: regulators may be able to leverage industry associations and professional norms to improve compliance, particularly in mature segments of the sector.

Comparison with Prior Research

The findings of this study are broadly consistent with prior research on regulatory compliance, while also offering novel insights.

Consistency with deterrence theory research. The strong effects of compliance cost and economic incentives align with Becker's (1968) classic formulation of deterrence and Nagin's (2013) review, which found that perceived certainty and severity of sanctions influence compliance behavior. The finding that negative incentives (compliance costs, sanctions) have slightly stronger effects than positive incentives is consistent with prospect theory .

Consistency with organizational studies. The finding that governance quality and organizational capacity influence compliance aligns with research on corporate governance and compliance . The partial mediation through compliance cost and economic incentives extends this literature by identifying mechanisms through which organizational factors operate.

Consistency with institutional theory. The finding that industry maturity moderates the compliance cost–compliance relationship is consistent with institutional theory's emphasis on normative pressures . However,

the non-significant moderation of the economic incentive–compliance relationship suggests that normative pressures operate selectively, influencing cost perceptions but not incentive perceptions.

Novel contributions. This study extends prior research by:

- Testing an integrated model drawing on four theoretical perspectives within a single analysis.

- Identifying compliance cost and economic incentives as mediating mechanisms.

- Demonstrating the selective moderation of industry maturity.

- Providing empirical evidence from a developing-country petroleum sector, a context that has received limited attention in compliance research.

Theoretical Implications

The findings have several implications for regulatory compliance theory.

Integration of theoretical perspectives. The study demonstrates that no single theory provides a complete explanation of compliance behavior. Instead, compliance decisions appear to be shaped by multiple, interacting factors: organizational capacity (institutional theory, compliance theory), regulatory characteristics (deterrence theory, compliance theory), economic calculations (deterrence theory, goal framing theory), and industry norms (institutional theory). This suggests that theoretical integration, rather than competition, is the most productive approach to understanding compliance behavior.

Specification of mediating mechanisms. The finding that compliance cost and economic incentives partially mediate the effects of organizational and regulatory factors suggests that these factors influence compliance not only directly but also by shaping the economic context of compliance decisions. This is consistent with goal framing theory's emphasis on gain goals and suggests that theories emphasizing organizational and regulatory factors should incorporate economic mechanisms more explicitly.

Conditional effects of industry maturity. The finding that industry maturity moderates the compliance cost–compliance relationship but not the economic incentive–compliance relationship suggests that institutional pressures operate selectively. This finding extends institutional theory by showing that normative pressures have specific, rather than general, effects on compliance behavior.

Policy and Managerial Implications

The findings have several implications for regulators and industry managers.

For regulators:

1. Balance enforcement and compliance cost reduction. While enforcement is important, the strong effect of compliance costs suggests that reducing the burden of compliance may be as effective,or more effective, than increasing enforcement. Regulators should consider simplifying procedures, providing compliance assistance, and implementing phase-in periods for new requirements.
2. Strengthen regulatory clarity and consistency. The effect of regulatory clarity suggests that reducing ambiguity and improving coordination among agencies (EWURA, TBS, PBPA, WMA, NEMC) could improve compliance. A single, clear compliance handbook and joint inspection protocols would reduce confusion and costs.
3. Leverage economic incentives. The strong effect of economic incentives suggests that interventions that make compliance economically beneficial, such as certification programs, market access benefits, or expedited permitting for compliant firms, could improve compliance.
4. Differentiate by industry maturity. The moderation effect suggests that in more mature segments of the sector, regulators may be able to rely more on industry associations and professional norms, while in less mature segments, cost reduction and assistance may be particularly important.

For managers:

1. Invest in governance and compliance systems. Better governance is associated with higher compliance, both directly and by reducing perceived compliance costs. Managers should consider establishing a compliance function, even if small, and ensuring board oversight of compliance issues.
2. Understand the true costs of compliance. The strong effect of perceived compliance cost suggests that managers who understand their compliance costs can make more informed decisions about resource allocation and may be able to identify cost-saving opportunities.
3. Engage with regulators. The effect of regulatory characteristics suggests that proactive engagement with regulators, seeking clarification, providing feedback, participating in consultations,can improve both regulatory clarity and firm compliance.
4. Leverage industry associations. The moderation effect suggests that participation in industry associations and professional bodies can reduce the perceived burden of compliance through information sharing, training, and normative pressure.

LIMITATIONS AND FUTURE RESEARCH

Limitations

Several limitations should be acknowledged.

Cross-sectional design and causal inference. The study uses cross-sectional data, which precludes strong causal claims. While the theoretical model posits directional relationships, the data are consistent with alternative causal orderings. Longitudinal data would be needed to establish temporal precedence and causation.

Self-report and common method bias. The study relies on self-report measures from single respondents within organizations. Self-report data may be subject to social desirability bias, and common method variance may inflate observed relationships. While Harman's single-factor test and common latent factor analysis suggested that common method bias is not a major concern, it cannot be completely ruled out.

Perceptual measures. The study relies on perceptual measures of compliance, compliance cost, regulatory characteristics, and other constructs. Perceptual measures may not correspond perfectly to objective reality. For example, perceived compliance costs may differ from actual costs, and perceived enforcement strength may differ from actual enforcement activity.

Geographic scope. Data were collected in Dar es Salaam region. While Dar es Salaam hosts the majority of petroleum infrastructure and OMCs, findings may not generalize to other regions with different characteristics (e.g., rural areas, smaller cities).

Sample composition. The sample of state-owned firms was small (n = 14), and the sample of regulatory officials (n = 37 across four agencies) limited subgroup analysis. The study's conclusions regarding state-owned firms should be interpreted with caution.

Future Research Directions

Several areas merit future investigation.

Longitudinal and panel studies. Future research should employ longitudinal or panel designs to establish causal relationships and examine how compliance behavior changes over time. This would allow testing of whether the factors identified in this study predict future compliance behavior.

Objective compliance measures. Future studies should incorporate objective measures of compliance, such as inspection results, violation records, or product quality test results, to complement self-report measures. This would reduce common method bias and provide more direct evidence of compliance behavior.

Comparative studies. Comparative research across regions (e.g., Dar es Salaam vs. other regions) or countries (e.g., Tanzania vs. Kenya, Uganda) would help establish the generalizability of findings and identify contextual factors that moderate compliance relationships.

Qualitative research. In-depth interviews or case studies could provide richer understanding of the mechanisms through which organizational and regulatory factors influence compliance decisions, including how managers perceive and respond to compliance costs and incentives.

Disaggregation of compliance. Future research should distinguish between different types of compliance (e.g., product quality vs. infrastructure standards) and different types of non-compliance (e.g., intentional vs. unintentional). The drivers of compliance may differ across these categories.

Integration of additional factors. Future models could incorporate additional factors such as manager characteristics, organizational culture, market competition, and broader political-economic context.

CONCLUSION

This study examined factors associated with compliance decisions regarding petroleum product quality and infrastructure standards in Tanzania's downstream petroleum sector. Drawing on Goal Framing Theory, Deterrence Theory, Institutional Theory, and Compliance Theory, the study tested an integrated model incorporating organizational, regulatory, economic, and contextual factors.

The findings suggest that compliance decisions are shaped by a complex interplay of organizational capacity, regulatory characteristics, economic calculations, and industry norms. Internal organizational characteristics and external regulatory characteristics influence compliance decisions both directly and indirectly through compliance cost and economic incentives. Compliance cost negatively influences compliance, while economic incentives positively influence compliance, with these economic factors exhibiting the strongest effects. Industry maturity moderates the compliance cost–compliance relationship but not the economic incentive–compliance relationship.

The study contributes to regulatory compliance theory by demonstrating the value of theoretical integration, identifying mediating mechanisms, and showing the selective moderation of industry maturity. It contributes to practice by providing evidence-based guidance for regulators and managers seeking to improve compliance.

The findings suggest that improving compliance in Tanzania's petroleum downstream sector requires a multi-faceted approach. Regulators should balance enforcement with compliance cost reduction, strengthen regulatory clarity, and leverage economic incentives. Managers should invest in governance and compliance systems, understand their compliance costs, and engage proactively with regulators. Industry associations can play a supportive role by providing compliance assistance and fostering professional norms.

Future research should employ longitudinal designs, incorporate objective compliance measures, and examine additional contextual factors. Such research will further our understanding of compliance behavior and provide evidence to support effective regulation.

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