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# COMPLIANCE LEVELS AND CHALLENGES IN IMPLEMENTING MARITIME SAFETY REGULATIONS AMONG SHIP OPERATORS IN LAKE VICTORIA, TANZANIA

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**Abstract**

*This study assesses the implementation of maritime safety regulations by ship operators on Lake Victoria, Tanzania, focusing on compliance levels and related challenges. Study used a descriptive research design, which is suitable for examining the current implementation of maritime safety regulations. It combined qualitative and quantitative data to assess compliance levels and challenges in implementing maritime safety regulation among ship operators. With a response rate of 96%, thematic analysis was used to examine interview transcripts and documentary reviews. Key themes such as regulatory challenges and compliance perceptions were identified through coding using NVivo 13 software. The findings reveal that although many operators are experienced, compliance is hindered by inadequate training, poor infrastructure,*

*outdated legislation, and weak enforcement. While majority of operators have higher education, a significant portion hold only secondary-level qualifications, indicating a need for targeted training programs. The study emphasizes the importance of adapting regulatory strategies to accommodate varying levels of operator experience and education. It concludes that enhancing maritime safety requires a multifaceted approach involving stricter enforcement, capacity-building, stakeholder collaboration, and investment in safety equipment and modern technology. Recommendations include updating maritime laws, conducting awareness campaigns, and providing financial support for safety improvements. The study also calls for further research into specific capacity-building programs, integration of international safety standards, and the socio-economic impacts of increased enforcement. These measures are essential for fostering a culture of compliance and improving safety outcomes in the region's maritime sector.*
*Keywords: Maritime Safety, Regulations, Ship Operators, Compliance Levels, Challenges*

## INTRODUCTION

The maritime industry plays an integral role in facilitating global trade, as it is responsible for the transportation of goods and passengers over considerable distances. Notwithstanding its essential contributions, the industry grapples with various risks, including maritime accidents, environmental threats, and overarching safety concerns. To mitigate these challenges, the International Maritime Organization (IMO), established in 1948, spearheads initiatives aimed at standardizing maritime safety through binding conventions. Notable among these are the International Convention for the Safety of Life at Sea (SOLAS), the International Maritime Solid Bulk Cargoes Code (IMSBC), and the International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW) (IMO, 2021). These conventions establish global benchmarks for ship construction, navigation protocols, crew training, and emergency responses. However, the actual implementation of these standards poses significant difficulties, particularly in developing nations where enforcement mechanisms, resources, and training programs are frequently insufficient (McKenna & Gunder, 2021).

In the African context, maritime safety remains a pressing issue, particularly given the rising frequency of incidents along the continent's extensive coastlines. Although regional frameworks such as the African Maritime Transport Charter and the African Union's Integrated Maritime Strategy have been formulated, their implementation across various African countries is often inconsistent. This inconsistency can be largely attributed to a deficiency in technical and financial resources, inadequate infrastructure, and irregular inspection regimes (Adebayo & Omotayo, 2020; Nwankwo, 2022).

Focusing on East Africa, where nations like Kenya, Tanzania, and Uganda are significantly reliant on maritime transport for trade, the challenges associated with enforcing international safety conventions are well-documented. Research illustrates that despite the adoption of IMO conventions, the region continues to confront persistent issues such as limited capacity building, inadequate enforcement of safety standards, subpar port infrastructure, and outdated shipping fleets (Nzuki & Otieno, 2021; Mwangi & Gitari, 2023).

Specifically in Tanzania, maritime safety is overseen by national bodies, including the Tanzania Shipping Agencies Corporation (TASAC). Nonetheless, significant challenges persist in the implementation of these regulations. Issues such as insufficient training of maritime personnel, a lack of safety equipment aboard vessels, and weak enforcement mechanisms hinder regulatory effectiveness (Mosha, 2020). Despite Tanzania's ratification of international conventions like SOLAS, the enforcement of these conventions is often limited, particularly among small-scale operators and fishermen.

Moreover, outdated infrastructure and deficient emergency response systems exacerbate the occurrence of maritime accidents, including shipwrecks and oil spills, which pose substantial risks to both human safety and the environment (Mwantimwa & Sumra, 2021). Therefore, there is an urgent need to evaluate the practical implementation of maritime safety regulations by ship operators in Lake Victoria, Tanzania. This assessment is essential to bridge the prevailing knowledge gap and to inform evidence-based policy and enforcement strategies.

## LITERATURE REVIEW

### Theoretical Literature Review

A theoretical literature review involves examining existing theories and frameworks related to a research topic to understand its conceptual foundations. It guides research design, identifies knowledge gaps, and helps shape research questions by evaluating the strengths and limitations of relevant theories (Bryman, 2016; Maxwell, 2021).

#### *Theory of Planned Behaviour*

The Theory of Planned Behavior (TPB), developed by Ajzen (1991), explains compliance behavior by focusing on individuals' intentions, which are shaped by attitudes, social norms, and perceived control. It suggests that compliance is influenced not only by enforcement but also by personal and social factors. In this study, TPB was used to analyze the compliance behavior of ship operators on Lake Victoria, Tanzania, regarding maritime safety regulations. The theory helped identify how operators' attitudes toward safety, community norms, and their perceived ability to implement safety measures affect their

willingness to comply. This approach highlighted key motivators and obstacles to regulatory compliance in the maritime sector (Ajzen, 1991; Mosha, 2020).

### *Institutional Theory*

Institutional theory, as proposed by DiMaggio and Powell (1983), explains how organizations adapt their practices in response to external pressures like laws, regulations, and cultural expectations to gain legitimacy and acceptance. In the context of Lake Victoria, this theory helps explain how ship operators and regulatory bodies in Tanzania adopt maritime safety practices in response to both national and international requirements. It also highlights whether such compliance is driven by genuine safety concerns or simply to satisfy regulatory expectations.

## Empirical Literature Review

### *Levels of compliance with maritime safety regulations by ship operators*

Several studies have explored compliance with maritime safety regulations across global and regional contexts. Nakamura et al. (2023) conducted a global multi-region analysis to evaluate adherence to international standards such as SOLAS and the ISM Code. Their study, based on data from over 500 vessels, found high compliance rates in developed regions (85%) but lower rates (65%) in developing areas due to weak enforcement and limited resources. They emphasized the importance of strengthening regulatory frameworks and incentivizing compliance.

In East Africa, Mhando and Salim (2024) assessed compliance among Lake Victoria ship operators in Tanzania. Using institutional theory and a mixed-methods approach, they found moderate compliance (58%) and highlighted barriers such as weak oversight, low awareness, and financial limitations. Operators affiliated with formal associations showed higher adherence, suggesting that organizational support enhances compliance.

Mosha (2020) focused on Lake Tanganyika and applied the Theory of Planned Behavior to examine compliance behavior. Despite awareness of safety regulations, actual compliance was low, hindered by limited enforcement and resource constraints. The study recommended increased inspections and improved training to boost compliance levels.

Nzuki and Otieno (2021) investigated factors influencing compliance on Lake Victoria using Risk Management Theory. They found that while operators understood the risks, enforcement was inconsistent, especially in remote areas. Financial constraints and limited infrastructure further impeded regulation adherence.

Lastly, Kamau and Mbura (2022) applied Compliance Behavior Theory in their analysis of ship operators on Lake Victoria. Their survey found relatively high compliance with basic

safety practices but notable gaps in emergency preparedness and crew training. The study advocated for more comprehensive training and stricter inspection protocols.

Collectively, these studies highlight recurring themes: the importance of regulatory capacity, training, financial resources, and organizational support in ensuring compliance with maritime safety regulations, especially in developing and inland waterway contexts like Lake Victoria and Lake Tanganyika.

**Key challenges faced by regulatory authorities in enforcing maritime safety regulations**

Issa et al. (2022) examined the regulatory challenges posed by the emergence of Maritime Autonomous Surface Ships (MASS). Grounded in theories of regulatory adaptation and technology governance, the study found that traditional maritime regulations are lagging behind technological advancements. Key issues include unclear liability frameworks, cybersecurity risks, and inadequate safety certification procedures. The authors argued for adaptive, real-time regulatory models and multi-stakeholder collaboration to effectively manage the risks posed by autonomous maritime technologies.

Benjamin (2025) evaluated the performance of the Nigerian Maritime Administration and Safety Agency (NIMASA) in enforcing maritime safety regulations. Using institutional capacity and governance theory, the study revealed major challenges such as underfunding, poor infrastructure, and weak inter-agency coordination. These issues hinder enforcement efficiency and weaken Nigeria's maritime safety framework. Recommendations included boosting NIMASA's budget, investing in inspection technologies, and improving institutional collaboration challenges that mirror broader systemic issues across many African maritime agencies.

Smith and Wang (2021) explored global regulatory enforcement challenges using Institutional Theory. Their review identified inconsistent implementation of international conventions like SOLAS and MARPOL due to limited resources, corruption, and differing political agendas. The study recommended enhanced global cooperation, stronger monitoring mechanisms, and financial support to help developing nations improve compliance capabilities.

**Research Gaps**

Despite existing research on maritime safety compliance, key gaps remain in the Tanzanian and broader African contexts. While global studies highlight enforcement and resource challenges, they often overlook localized socio-economic and institutional factors. Regional studies, such as those by Mhando and Salim (2024) and Mosha (2020), focus on specific barriers but lack broader comparative or technological perspectives. There is limited research on the impact of operator associations and adaptive regulatory frameworks. Thus, more

comprehensive, multi-level studies are needed to address compliance by incorporating socio-economic, institutional, and technological factors relevant to African maritime contexts.

## METHODOLOGY

### Study Design

A research design is the strategic plan for collecting and analyzing data to address a research problem effectively (Yin, 2016; Saunders et al., 2016). This study used a descriptive research design which is suitable for examining the current implementation of maritime safety regulations. It combined qualitative and quantitative data to assess compliance levels, challenges, and influencing factors, offering an in-depth understanding of the issue (Kothari, 2014).

### Study Area

This study is focused on the Tanzanian section of Lake Victoria, particularly the port towns of Mwanza, Bukoba, and Musoma. These towns are key maritime hubs with numerous ship operators and regulatory bodies. Given Lake Victoria's importance for transportation, trade, and fishing, alongside its maritime safety challenges, this area provides a suitable context for assessing the implementation of safety regulations in Tanzania.

### Target Population and Sample Size

The target population for the study included ship operators, TASAC officials, and port authority representatives in Mwanza, Bukoba, and Musoma. These stakeholders play key roles in implementing and overseeing maritime safety regulations in Lake Victoria. A sample of 150 participants comprising ship operators, regulatory officials, and stakeholders from Mwanza, Bukoba, and Musoma was selected using Slovin's formula from an estimated population of 500. With a 95% confidence level and a 5% margin of error, the sample ensured statistical representativeness and practical manageability, offering reliable insights into maritime safety regulation implementation. The sample size for this study was determined as shown below:

$n = N \div (1+Ne2)$

Where: n = is the number of samples (required)

N = Total population (240)

e = Error tolerance (level) or margin of error (0.05)

Hence; $n = 240/ (1+240/ (0.05)2) = 150$

Therefore, the sample size for this study was 150 respondents

### Sampling Technique

Sampling techniques determine how participants are selected and impact a study's accuracy and reliability (Kothari, 2004; Saunders et al., 2016). This study used both stratified random sampling and purposive sampling. Stratified sampling ensured proportional representation of ship operators, regulators, and other stakeholders, while purposive sampling targeted key informants like TASAC and port officials for their specialized knowledge. This combination enhanced both representativeness and depth of insights.

### Data Collection Tools

Data collection involves systematically gathering information (Kothari, 2014; Saunders et al., 2016). This study used both primary and secondary data sources. Primary data was obtained through questionnaires to ship operators, interviews with TASAC and port officials, and direct observations at Mwanza, Bukoba, and Musoma ports. These methods provided both quantitative and qualitative insights into maritime safety practices. Secondary data, drawn from reports, journals, and official records, complemented the primary data by offering contextual and historical perspectives. Together, these sources ensured comprehensive and reliable findings.

### Instruments' Validity and Reliability

Validity ensures that research instruments accurately measure what they are intended to measure (Yin, 2016; Saunders et al., 2016). In this study, validity was strengthened through pilot testing of questionnaires and interview guides, expert input, and alignment with maritime safety regulations to ensure content coverage. Triangulation using questionnaires, interviews, and document reviews further enhanced the credibility and accuracy of the findings.

Reliability refers to the consistency of research instruments in producing stable results (Kothari, 2004; Saunders et al., 2016). In this study, reliability was verified with Cronbach's $\alpha = 0.872$ surpassing the 0.70 rule-of-thumb for acceptable internal consistency, standardized data collection procedures. Triangulation of data sources further strengthened the dependability of findings by reducing bias and confirming consistency across perspectives.

### Data Analysis

Qualitative data analysis involves interpreting non-numerical data to uncover patterns and themes (Kothari, 2004; Saunders et al., 2016). In this study, thematic analysis was used to examine interview transcripts and documentary reviews. Key themes such as regulatory challenges and compliance perceptions were identified through coding using NVivo 13 software. Expert review helped ensure the consistency, validity, and reliability of the findings, providing a

deep understanding of maritime safety regulation implementation in Lake Victoria. Quantitative data analysis involves using statistical methods to examine numerical data, identify patterns, and test relationships (Kothari, 2004; Saunders et al., 2016). Here, data from questionnaires were analyzed using descriptive statistics. Data cleaning ensured accuracy, supporting a reliable and evidence-based evaluation of maritime safety regulation implementation on Lake Victoria.

## FINDINGS

### Levels of Compliance with maritime safety regulations by ship operators in Tanzania

The study found varying levels of compliance with maritime safety regulations among ship operators on Lake Victoria, influenced by factors such as awareness, resource availability, and regulatory enforcement. While some operators follow safety standards, others struggle due to limited resources or knowledge. The findings highlight the need for stronger enforcement, better stakeholder collaboration, and capacity-building efforts to improve compliance and enhance maritime safety in Tanzania.

Table 1: The compliance level of maritime safety regulations by ship operators in Lake Victoria, Tanzania

| Statement | SA | A | N | D | SD | Mean |
|---|---|---|---|---|---|---|
| Ship operators are fully aware of maritime safety regulations | 12 | 18 | 7 | 62 | 45 | **2.24** |
| Training programs on maritime safety are regularly attended by ship operators | 7 | 13 | 3 | 68 | 54 | **1.98** |
| Clear communication exists regarding updates to maritime safety regulations | 23 | 37 | 5 | 43 | 36 | **2.78** |
| Safety equipment is installed and maintained as per the regulations | 17 | 24 | 11 | 53 | 39 | **2.49** |
| Ship operators conduct mandatory safety drills and inspections regularly | 20 | 33 | 3 | 49 | 39 | **2.62** |
| The guidelines for cargo handling are strictly followed by ship operator | 17 | 23 | 4 | 57 | 43 | **2.40** |
| Incidents and non-compliance issues are reported promptly by ship operators | 24 | 18 | 5 | 49 | 48 | **2.45** |
| Proper documentation and logs are maintained to track compliance with safety standards | 32 | 21 | 12 | 38 | 41 | **2.76** |
| Penalties for non-compliance are effective in enforcing safety regulations | 17 | 37 | 12 | 41 | 37 | **2.69** |
| Ship operators cooperate effectively with regulatory authorities during inspections | 24 | 33 | 3 | 57 | 27 | **2.79** |
| Ship operators face significant challenges in complying with maritime safety regulations | 27 | 41 | 4 | 40 | 32 | **2.93** |
| Government support and incentives encourage compliance among ship operators. | 11 | 21 | 20 | 51 | 51 | **2.44** |

The findings in Table 1 reveal generally low levels of compliance with maritime safety regulations among ship operators on Lake Victoria, Tanzania. Mean scores ranged from 1.98 to 2.93, all below the neutral midpoint of 3.00, indicating gaps in training, awareness, and implementation. The lowest score (1.98) reflects poor participation in safety training, while awareness of regulations also scored low (2.24), pointing to significant knowledge gaps. Slightly higher scores were observed for communication clarity (2.78) and cooperation during inspections (2.79), though still below ideal levels. The highest score (2.93) suggests that operators face notable challenges in complying with regulations, likely due to resource limitations, infrastructure deficits, and weak enforcement. Penalties for non-compliance received a moderate score (2.69), suggesting they are only partially effective.

Overall, the data suggest systemic issues in regulation enforcement and operator preparedness. Although inferential statistics were not applied, the consistently low means strongly indicate poor implementation. Given the broad geographic coverage of ports like Mwanza, Bukoba, and Musoma, the results are generalizable to inland maritime operations within Tanzania's section of Lake Victoria, but may not apply to other regions without further research.

Interviews with TASAC senior and legal officers reveal that compliance with maritime safety regulations among ship operators on Lake Victoria is inconsistent, primarily due to low awareness, limited training, and weak enforcement mechanisms. NVivo-coded themes such as “low training attendance,” “inadequate awareness,” and “regulatory enforcement challenges” highlight key barriers, including weak penalties, inconsistent inspections, and limited collaboration.

Additional issues identified include resource and technological limitations, such as outdated infrastructure and a lack of monitoring tools, and economic barriers, where operators struggle to afford safety equipment. Poor communication between regulatory bodies and stakeholders, coded as “communication gaps,” also hampers effective regulation.

**Key Challenges faced by regulatory authorities in enforcing maritime safety regulations in Tanzania**

The study found that regulatory authorities in Tanzania face major challenges in enforcing maritime safety regulations, including limited resources, inadequate enforcement tools, poor surveillance, weak inter-agency coordination, and low stakeholder awareness. Corruption and lack of political support also hinder enforcement. Addressing these issues requires better funding, capacity building, and improved stakeholder collaboration.

Table. 2: Key challenges faced by regulatory authorities in enforcing maritime safety regulations

| Statement | SA | A | N | D | SD | Mean |
|---|---|---|---|---|---|---|
| Regulatory authorities face insufficient funding to enforce maritime safety regulations effectively | 44 | 62 | 6 | 19 | 13 | **3.72** |
| There is a lack of adequate equipment and technology for monitoring compliance | 59 | 44 | 4 | 13 | 24 | **3.70** |
| Human resource shortages hinder effective enforcement of maritime safety regulations | 30 | 67 | 13 | 7 | 27 | **3.46** |
| Maritime safety laws and regulations are outdated or inadequate to address current challenges | 44 | 58 | 4 | 23 | 15 | **3.64** |
| Penalties for non-compliance with maritime safety regulations are not strict enough to deter violations | 32 | 43 | 6 | 35 | 28 | **3.11** |
| Ship operators frequently resist compliance with maritime safety regulations | 39 | 47 | 10 | 27 | 21 | **3.39** |
| There is limited cooperation from stakeholders such as port authorities and shipping companies | 33 | 45 | 15 | 25 | 26 | **3.23** |
| Poor communication between regulatory authorities and stakeholders hinders enforcement efforts | 24 | 37 | 8 | 42 | 33 | **2.84** |
| Tanzania's vast coastline and remote ports make it difficult to enforce safety regulations uniformly | 23 | 38 | 17 | 32 | 34 | **2.89** |
| Adverse weather conditions and limited maritime infrastructure pose challenges to enforcement | 51 | 54 | 6 | 18 | 15 | **3.75** |
| Regulatory staff lack adequate training on maritime safety enforcement | 46 | 56 | 8 | 23 | 11 | **3.71** |
| There are insufficient capacity-building programs to support regulatory authorities | 52 | 53 | 10 | 17 | 12 | **3.80** |
| International standards and practices are not fully integrated into local enforcement mechanisms | 42 | 51 | 6 | 29 | 16 | **3.51** |

The findings in Table 2 reveal major challenges faced by maritime regulatory authorities in Tanzania including insufficient capacity-building (mean = 3.80), adverse weather and poor infrastructure (mean = 3.75), and lack of funding and training (means = 3.72 and 3.71) ranking highest. Other notable issues include outdated laws and limited monitoring technology. Challenges like poor communication and vast coverage areas were rated lower. Statistical analysis ($t = 4.83$, $p = 0.00041$) confirms these challenges are significant and widely recognized by stakeholders across Mwanza, Bukoba, and Musoma. Addressing them requires increased funding, updated regulations, better training, and improved technology. While generalizable to similar inland settings in Tanzania, broader application across Africa would require further research.

The study gathered insights from TASAC senior officers, revealing several key challenges in enforcing maritime safety regulations in Tanzania. These challenges were grouped into five main themes.

Financial constraints limit the ability to invest in modern equipment and conduct regular inspections, especially in remote areas, making enforcement reactive. Capacity-building gaps reflect a shortage of trained staff with the technical skills needed for effective regulation. Outdated laws and policies weaken enforcement due to inadequate penalties and misalignment with current international standards. Technological limitations, such as the lack of real-time monitoring tools, hinder the detection and response to safety violations. Lastly, stakeholder collaboration issues stem from poor coordination and communication with ship operators, which obstructs compliance efforts.

These themes, identified through NVivo analysis, demonstrate how resource shortages and legal gaps significantly reduce the effectiveness of maritime safety enforcement on Lake Victoria.

## DISCUSSION

The findings underscore the need for capacity-building initiatives, regulatory framework improvement, and enhanced stakeholder engagement to strengthen maritime safety compliance in Tanzania. The study's findings on maritime safety compliance among ship operators on Lake Victoria align closely with existing empirical literature. Low participation in safety training (mean = 1.98) and limited awareness of safety regulations (mean = 2.24) mirror findings by Mosha (2020) and Kamau & Mbura (2022), who identified insufficient training and poor information dissemination as major barriers to compliance. Interview insights from TASAC officials also support these observations, citing inadequate operator knowledge and weak enforcement practices.

Moderate levels of cooperation with regulatory authorities (mean = 2.79) and significant challenges in compliance (mean = 2.93) further align with studies by Mwantimwa & Sumra (2021) and Nzuki & Otieno (2021), which reported resource limitations and enforcement difficulties, especially in remote areas. TASAC interview data confirmed these barriers, highlighting weak penalties, lack of equipment, and insufficient infrastructure as key constraints.

Overall, the study reinforces the need for targeted training, stronger regulatory frameworks, and improved coordination between ship operators and enforcement bodies to enhance maritime safety compliance in Tanzania.

The study’s findings are consistent with existing empirical literature on the challenges faced by maritime regulatory authorities, particularly in areas such as resource limitations, outdated legal frameworks, and technological gaps. Smith and Wang (2021) identified global enforcement barriers including limited financial and technical support, which align with this study’s findings on insufficient funding (mean = 3.72), outdated laws (mean = 3.64), and inadequate monitoring equipment (mean = 3.70).

Similarly, Nkwinika and Tetteh (2020) emphasized resource shortages and inadequate training, reflected in the current study's capacity-building gaps (mean = 3.71). Regional studies by Mwantimwa and Sumra (2021) and Nzuki and Otieno (2021) reported similar issues in East Africa specifically, poor funding, outdated technology, and weak coordination, which correspond with this study's findings on technological limitations (mean = 3.70) and enforcement disparities. Additionally, lower mean scores for communication (2.84) and enforcement coverage (2.89) support observations by Nzuki and Otieno about regional inconsistencies in regulatory performance.

In summary, study reinforces patterns documented in previous literature and highlights the need for targeted, multi-level strategies to improve maritime safety enforcement in Tanzania.

## CONCLUSION

The study reveals low compliance with maritime safety regulations among Lake Victoria ship operators, with mean scores between 1.98 and 2.93. Major issues include limited training, low awareness, and weak enforcement. TASAC interviews confirm challenges like resource shortages, outdated infrastructure, poor communication, and enforcement gaps.

Improving compliance requires targeted training, modernized infrastructure, stronger enforcement, and enhanced stakeholder collaboration. Findings apply to Tanzania's inland maritime context, though wider regional validation is needed.

The study reveals that maritime regulatory authority in Tanzania face major enforcement challenges, including limited funding, outdated laws, poor infrastructure, and inadequate training. TASAC officials highlighted five core issues: financial constraints, human resource gaps, weak regulatory frameworks, technological limitations, and poor stakeholder coordination. These factors undermine effective compliance and monitoring.

## RECOMMENDATIONS

The study recommends targeted strategies to improve maritime safety on Lake Victoria, including enhanced training, updated regulations, improved enforcement, better infrastructure, and stronger collaboration among stakeholders to boost compliance and safety standards.

- Enhance inspection and monitoring with modern technology, implement balanced enforcement using both penalties and incentives, and foster regular dialogue between ship operators and regulators to improve compliance and develop joint solutions.
- Implement targeted awareness campaigns using varied media to highlight maritime safety importance, provide financial support through subsidies or grants for safety equipment, and enhance collaboration among ship operators, regulators, and stakeholders to improve enforcement and compliance.

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