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# Assessing the Impact of Multilane Free Flow on Vehicle Operating Costs and Logistics Efficiency in Indonesia Using SWOT Analysis Approach

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**ABSTRACT**

Indonesia's logistics sector faces high costs and inefficiencies due to toll road congestion and delays. Multilane Free Flow (MLFF) offers a solution by enabling seamless toll transactions that can reduce delays and costs. Using a SWOT framework, with RBV and Institutional Theory, this study assesses MLFF's impact. It highlights MLFF's strengths in efficiency, lower VOC, safety, and environmental benefits. Challenges include technological accuracy, financial viability, user acceptance, and fragmented regulations. Public support offers opportunities for adoption, but implementation needs regulatory reform, infrastructure upgrades, and stakeholder collaboration. MLFF could reduce logistics costs and enhance competitiveness, but success depends on overcoming hurdles through coordinated efforts.



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## INTRODUCTION

Transportation is a core component of supply chain management, as production and consumption rarely occur in the same location [1], [2]. It enables the movement of raw materials, intermediate goods, and finished products from their points of origin to end users through various modes, including road, rail, maritime, air, and multimodal systems [3], [4]. As a primary logistics activity, transportation represents one of the largest cost components in supply chains and is highly visible to customers, directly influencing service levels and overall supply chain performance [5], [6]. In the context of logistics and supply chain operations, transportation performance affects procurement, production, inventory management, and customer responsiveness [7], [8]. Inefficient transportation systems increase travel time, fuel consumption, and operational disruptions, leading to higher logistics costs and reduced competitiveness [9]. As a consequence, improving transportation efficiency is critical for reducing vehicle operating costs and enhancing the overall effectiveness of supply chains.

Logistics costs in Indonesia remain high, accounting for approximately 25% of GDP, which is considerably above regional peers such as Vietnam (20%), Thailand (15%), China (14%), and advanced logistics economies such as Singapore and Japan (8%) [10]. Transportation is the dominant cost component, contributing nearly half of total logistics costs, followed closely by inventory costs, while administrative expenses remain relatively small [11]. Newer data from a report by Pelindo stated that land transportation contributes the second largest percentage, namely 8.5%. Other costs include inventory costs at 8.9%, sea transportation at 2.8%, administration at 2.7%, and 0.8% other costs [12].

High logistics costs are widely recognized as a key factor undermining Indonesia's national competitiveness in international markets [13], [14], [15]. Several structural challenges continue to drive these inefficiencies. First, imbalances in the flow of goods arise from uneven regional economic development. Westbound freight movements dominate, while eastbound backhaul trips often carry limited cargo, forcing outbound shipments to absorb most round-trip transportation costs and inflating freight rates, particularly to eastern regions [16], [17]. Second, inadequate infrastructure remains a persistent constraint. Despite increased investment, infrastructure development is uneven across regions, with fragmented road networks, deteriorated road conditions, and insufficient integration across land, rail, maritime, and air transport systems. These shortcomings contribute directly to high logistics costs and Indonesia's relatively low Logistics Performance Index ranking [18], [19], [20].

Third, ineffective subsidy policies have failed to address the structural causes of logistics inefficiencies. Short-term subsidies provide limited relief and do not resolve underlying issues such as port congestion, outdated facilities, and weak intermodal connectivity. Redirecting public funds toward infrastructure modernization and operational efficiency is therefore considered more sustainable [21], [22]. Finally, illegal levies and informal charges continue to impose additional burdens on logistics operators. These practices increase direct costs, disrupt loading and unloading processes, delay land transportation, and generate broader systemic inefficiencies across logistics networks [23], [24].

To address Indonesia's persistently high logistics costs, coordinated efforts between government agencies and industry stakeholders are required to implement integrated and technology-driven solutions that go beyond conventional infrastructure expansion expansion [11], [17], [25]. One critical area for intervention is traffic congestion, particularly at toll gates, which contributes significantly to travel delays, higher vehicle operating costs, and logistics inefficiencies. In the Jabodetabek region, traffic congestion generates substantial economic losses, estimated at Rp 71.4 trillion annually, with toll gate queues representing a major contributing factor [26]. Despite the expansion of toll road infrastructure, congestion persists as vehicle growth continues to outpace supporting capacity, especially in urban areas [27]. Although electronic toll (e-Toll) systems have reduced reliance on cash payments, vehicles are still required to stop at toll gates, interrupting traffic flow, increasing delays, and reducing freeway efficiency [28], [29]

To overcome these limitations, Multilane Free Flow (MLFF) technology offers a viable solution by enabling seamless, non-stop toll transactions without requiring vehicles to slow down or stop [30]. The elimination of stopping behaviour improves traffic flow, reduces queue lengths, and lowers fuel consumption and emissions, with reported reductions of $CO_2$ by 25%–45% and $NO_x$ by 32%–98%, depending on vehicle type and operating conditions [31]. In addition to operational and environmental benefits, MLFF demonstrates stronger financial performance than conventional e-Toll systems, including higher NPV and IRR and a shorter investment payback period [32], [33]. Furthermore, free-flow tolling systems offer higher throughput capacity than existing automatic and semi-automatic toll gates, effectively eliminating toll plaza bottlenecks [34].

Toll road payment systems in Indonesia have evolved from manual cash-based transactions to increasingly automated electronic toll collection systems. Initially introduced in 1987, cash payments at toll gates required vehicles to stop completely, resulting in long transaction times and significant queue formation, particularly during peak traffic periods [35]. To improve efficiency, Indonesia mandated the use of electronic toll (e-Toll) payments nationwide in 2017. While this transition reduced reliance on cash and improved transaction reliability, vehicles are still required to stop at toll gates, resulting in average delays of approximately 13.6 seconds per transaction, which continue to contribute to congestion on major toll roads [36], [37], [38]

Subsequent developments introduced Single Lane Free Flow (SLFF) as a non-stop payment system in every transaction lane. This system allows vehicles to no longer need to stop at toll gates to tap transactions [39]. With this system, it is hoped that it can prevent the accumulation of transaction queues at toll gates. Travel time is also faster because vehicles no longer need to stop and queue to make transactions at toll gates [40]. However, for SLFF, there is only one lane that uses a free-flow system. Multilane Free Flow (MLFF) represents the most advanced stage of toll payment evolution, allowing fully non-stop toll collection across all lanes. In Indonesia, MLFF is implemented using Global Navigation Satellite System (GNSS) technology, which offers greater flexibility, lower operational costs, and easier scalability compared to RFID and DSRCbased systems that require extensive roadside infrastructure and vehicle-side installations [34], [41], [42]. By eliminating the need for vehicles to slow down or stop, MLFF significantly improves toll road capacity, reduces queue formation, and enhances traffic flow compared to conventional automatic and semi-automatic toll gates [28], [30], [34]. These operational improvements translate into lower vehicle service time, reduced fuel consumption, and decreased vehicle operating costs.

**Theoretical Framework**

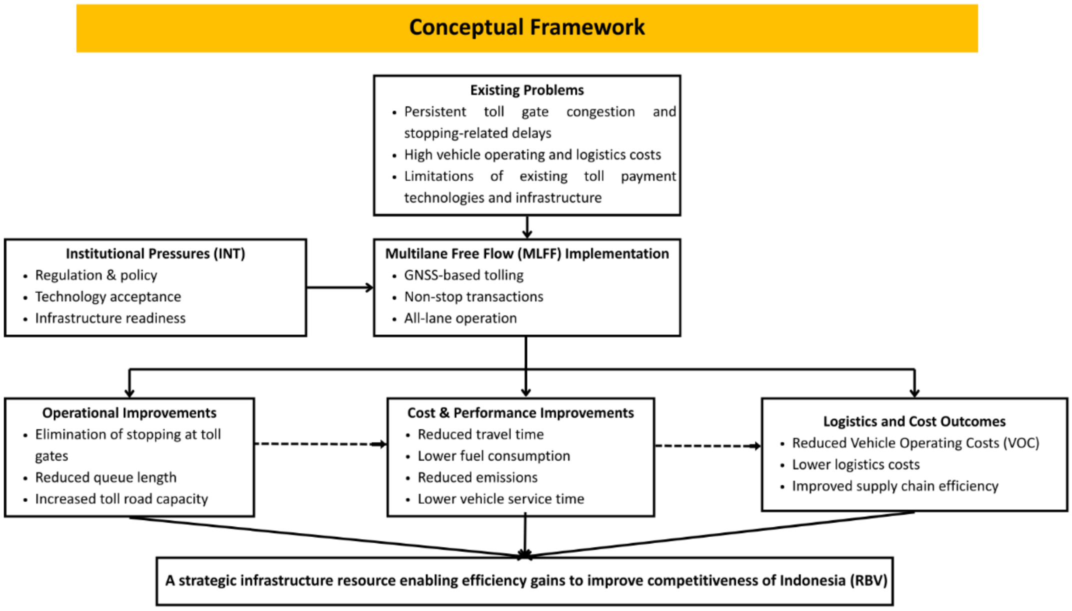
This study draws on the Resource-Based View (RBV) and Institutional Theory (INT) to examine the role of toll road payment systems in reducing vehicle operating costs and logistics inefficiencies. RBV posits that competitive advantage stems from valuable, scarce, and well-managed resources, including both tangible and intangible assets [20], [43], [44], [45], [46]. Within logistics and supply chain management, transportation infrastructure constitutes a strategic resource that directly affects operational efficiency, cost performance, and service reliability [43]. Efficient toll road infrastructure, supported by advanced technologies, enables firms to optimize routing, reduce delays, and lower transportation-related costs, thereby enhancing overall logistics performance [20], [43], [46].

Complementing RBV, Institutional Theory emphasizes the influence of external regulatory, normative, and cultural-cognitive forces on organizational behavior and infrastructure development [47], [48]. In the context of transportation systems, government regulations, industry standards, and professional norms act as institutional pressures that shape the adoption of new technologies. These pressures manifest through coercive mechanisms (e.g., regulations and mandates), mimetic behavior (imitation of industry leaders), and normative influences arising from professional networks and established practices [49], [50], [51]. As such, infrastructure innovation is not driven solely by efficiency considerations but also by institutional legitimacy and policy alignment [52], [53], [54].

Although the transition from manual toll payments to electronic tolling has improved efficiency, Indonesia's current e-Toll system still requires vehicles to stop at toll gates, resulting in delays, congestion, and increased vehicle operating costs. Empirical evidence from the literature review shows that average waiting times of approximately 13.6 seconds per vehicle continue to contribute to fuel consumption, emissions, and productivity losses, particularly in dense urban regions such as Jabodetabek. These inefficiencies exacerbate Indonesia's already high logistics costs and undermine transportation system performance.

Multilane Free Flow (MLFF) technology has been proposed as a potential solution by enabling non-stop toll transactions and improving traffic flow. However, as can be seen in previous literature, concerns over technological accuracy, infrastructure readiness, financial feasibility, regulatory frameworks, and public acceptance continue to limit the adoption of MLFF. Without a comprehensive evaluation of its impact, particularly on VOC and logistics efficiency, policymakers and industry stakeholders lack the empirical evidence needed to justify large-scale investment and implementation. Therefore, the central problem addressed in this paper is the need to critically assess the potential of MLFF to reduce vehicle operating costs and logistics inefficiencies in Indonesia, while also considering the institutional, technological, and social challenges that may affect its successful deployment. This study approaches this problem using the conceptual framework illustrated in Figure 1.

**Figure 1**. Conceptual Framework




## RESEARCH METHOD

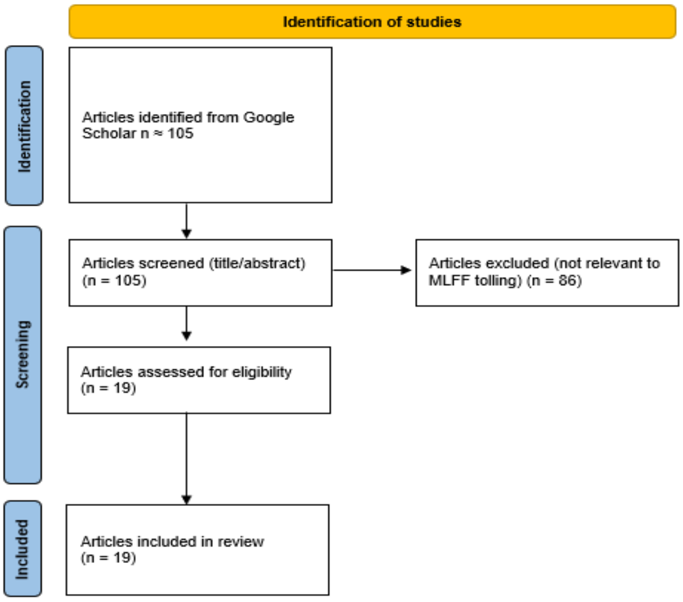
This study employed a secondary research design based on a systematic review of peer-reviewed literature. A purposive sampling approach was used to select 19 academic publications addressing Multilane Free Flow (MLFF) or comparable barrier-less tolling systems. The selection criteria included relevance to the research objectives, availability of empirical evidence, and applicability to the Indonesian context. Key findings, reported outcomes, and contextual insights were extracted from the selected studies and synthesized to form the basis of the analysis.

A SWOT analysis framework was applied as the primary analytical tool to integrate evidence from diverse sources and to evaluate the internal strengths and weaknesses as well as external opportunities and threats associated with MLFF implementation. SWOT analysis has been widely used across multiple fields due to its flexibility, including infrastructure development, innovation assessment, and policy evaluation [55]. In this study, the framework facilitated a structured assessment of MLFF's technical, operational, and institutional dimensions, enabling a comprehensive evaluation beyond descriptive findings reported in individual studies.

## RESULT AND DISCUSSION

The study selection process followed the PRISMA 2020 guidelines to ensure transparency and reproducibility. A structured manual search was performed using Google Scholar, applying combinations of keywords such as "multi lane free flow", "multilane free flow", "toll", "open road", "free flow" and "SWOT analysis." The search included both Indonesian and English-language publications and focused on studies discussing the implementation of MLFF or similar systems, operational performance, technical studies regarding the technologies used in MLFF such as RFID, or adoption issues. Approximately 105 records were identified from the initial search results. Titles and abstracts were screened to exclude studies whose findings were not applicable for the MLFF context or that did not provide relevant insights into the SWOT framework. After this screening process, 19 full-text articles were retained and assessed for eligibility. All 19 met the inclusion criteria and were subsequently incorporated into the final qualitative synthesis. The overall process of study identification and selection is illustrated in Figure 2.

**Figure 2**. PRISMA-style Flow Diagram




In order to evaluate the potential role of MLFF technology in reducing logistics inefficiencies and vehicle operating costs, the findings from the reviewed literature were systematically synthesized and interpreted. The analysis was organized within the SWOT framework, enabling a structured assessment of MLFF's internal strengths and weaknesses alongside the external opportunities and threats that may shape its implementation in Indonesia. The findings from the literature are presented and categorized according to its theme and category in Table 1.

**Table 1.** Results of Literature Review Categorized Regarding technical and Operational Aspects (Strengths & Weaknesses)

| Category | Key Themes | Synthesized Evidence from Literature |
|---|---|---|
| **Strengths** | Reduced delay and queue length | MLFF eliminates stopping at toll gates, resulting in near-zero transaction time, significant reductions in queues (≈27%) and delays (≈31%), and smoother traffic flow compared to manual and card-based tolling systems [56], [57], [58]. |

| Category | Key Themes | Synthesized Evidence from Literature |
|---|---|---|
| | Lower vehicle operating costs (VOC) | By removing idling and stop–go movements, MLFF reduces fuel consumption (≈15%) and substantially lowers VOC across passenger and freight vehicles, particularly in congested toll plazas [28], [59], [60]. |
| | Environmental benefits | Free-flow tolling significantly reduces emissions, including $CO_2$ (25–45%) and $NO_x$ (32–98%), due to uninterrupted vehicle movement and lower fuel use [56], [61], [62]. |
| | Increased road capacity | MLFF increases toll road throughput and effective vehicle capacity compared to automatic and semi-automatic toll gates, effectively eliminating toll plaza bottlenecks [34], [57]. |
| | Improved safety | Barrier-free tolling systems reduce crash frequency at toll plazas by 17–76%, primarily by removing stop-and-go conflicts and lane-changing behavior near toll gates [63], [64]. |
| **Weaknesses** | Accuracy and reliability issues | GNSS-based MLFF systems face positioning inaccuracies (vertical errors >10 m), require augmentation systems, and are vulnerable to jamming and spoofing, raising concerns over billing accuracy and enforcement reliability [42], [61], [65]. |
| | Infrastructure and system dependency | Successful MLFF implementation depends on extensive supporting infrastructure, accurate digital maps, enforcement mechanisms, and regulatory readiness, increasing technical and operational complexity [34], [66]. |
| | Economic and financial concerns | Although MLFF projects show slightly higher IRR and faster returns than conventional e-toll systems, the differences are marginal, with long payback periods of up to 32 years and high capital and operational costs [33], [61]. |
| | User acceptance and social concerns | Adoption is constrained by privacy concerns related to vehicle tracking, low perceived value of onboard units (only ~23% consider them worthwhile), and inefficiencies for occasional users without OBUs [57], [61] |
| | Operational transition risks | Mixed operation of MLFF with conventional ETC systems may create driver confusion and elevate crash risks during transition phases [64]. |

Based on the findings presented in the SWOT framework, the following discussion interprets these results in light of the RBV theory and Institutional Theory. This theoretical integration provides a deeper understanding of how MLFF's identified strengths, weaknesses, opportunities, and threats can be explained beyond their descriptive characteristics and be connected to the efforts to decrease logistics cost in the form of Vehicle Operating Cost for both governments and logistic operators alike.

**Strengths**

The review of existing studies shows that MLFF systems consistently deliver benefits across efficiency, environmental, and safety dimensions. The strengths identified such as reduced delays, shorter transaction times, lower queue lengths, decreased fuel consumption, reduced pollutant emissions, increased vehicle capacity, and higher road safety can be interpreted from the lens of RBV as a set of resources and capabilities. From an RBV perspective, these attributes of MLFF can be classified as strategic resources that provide toll operators and the wider transportation system in Indonesia with a competitive advantage. First, they are valuable, as they directly contribute to lowering vehicle operating costs (VOC). Reduced delays, queue lengths, and transaction times translate into less wasted fuel, lower maintenance requirements, and greater productivity for both individual drivers and logistics operators. At the same time, lower emissions and higher safety levels reduce external costs associated with health and accident-related losses, creating broad social and economic value.

Second, these resources can be considered rare within the Indonesian context. Current card-based and semi-automatic toll systems do not deliver the same level of operational efficiency. MLFF's ability to eliminate queues and enable uninterrupted travel is not yet widely available across Indonesia, meaning that early adopters stand to gain unique advantages in terms of reduced congestion and logistics efficiency.

Third, MLFF's benefits are inimitable due to the significant infrastructural, technological, and institutional investments required to implement such systems. Unlike incremental upgrades to card-based tolling, MLFF requires integrated systems of roadside sensors, RFID or ANPR (automatic number plate recognition), and back-end enforcement platforms. These barriers to imitation suggest that once implemented, the competitive advantage derived from MLFF is not easily replicable by rival systems. Finally, MLFF's capabilities are non-substitutable. Alternative tolling mechanisms, such as manual booths or other free-flowing ETCs, cannot simultaneously reduce fuel consumption, cut emissions, shorten delays, and improve safety to the same degree. This makes MLFF a distinct solution for reducing vehicle operating costs while also supporting wider transportation and environmental policy goals of Indonesia. Thus, from an investment point of view, MLFF can also further assist in increasing the logistics efficiency of the Indonesian manufacturing sector, a very relevant concern to Indonesia [67]

**Weakness**

While MLFF has demonstrated its potential as a strategic resource, the literature also highlights several weaknesses that constrain its effectiveness in the Indonesian context. Through the RBV framework, these weaknesses can be interpreted as gaps in the resources and capabilities required for MLFF to deliver sustained competitive advantage. First, MLFF technologies, particularly those dependent on GNSS, face accuracy and reliability limitations. Errors exceeding 10 meters in vertical accuracy, the need for augmentation systems, and vulnerability to jamming and spoofing indicate that MLFF does not yet meet the requirements of valuable and reliable resources. This is particularly relevant because Indonesian MLFF is a GNSS-based system. In RBV terms, a resource that lacks consistency and robustness cannot sustain operational efficiency. These technological shortcomings also raise safety risks, especially when MLFF is implemented alongside conventional ETC systems, potentially causing driver confusion and increasing crash risks.

Second, economic and financial weaknesses reduce MLFF's value proposition. High capital expenditures for infrastructure and operational costs for enforcement strain resources. The low perceived value of onboard units (with only 23% of users regarding them as worthwhile) further undermines MLFF's ability to generate user buy-in. This is despite GNSS being one of the cheapest MLFF systems. This aspect is especially important for the calculation of Vehicle Operating Cost. Although toll projects using MLFF demonstrate higher and faster returns than conventional systems, the improvement is marginal, with a 32-year payback period still required. From the RBV perspective, such resource intensity without proportional unique benefits limits MLFF's ability to be classified as valuable or rare.

Third, user and social acceptance issues highlight weaknesses in MLFF as a resource that is neither inimitable nor non-substitutable. Privacy concerns over the tracking of vehicle movements, inefficiencies for occasional users without onboard units, and the relatively low maturity of GNSS-based MLFF compared to established electronic tolling systems suggest that MLFF is not yet perceived as irreplaceable or superior. If users view existing systems as adequate substitutes, MLFF loses its potential for sustained advantage. Finally, institutional and regulatory gaps hinder MLFF's transformation into a strategic resource. Successful implementation requires extensive supporting infrastructure, accurate navigation databases, and strong enforcement regulations. In the absence of these complementary capabilities, MLFF cannot achieve its VRIN potential. In RBV terms, Indonesia's institutional environment currently lacks the complementary resources needed to unlock the full value of MLFF.

**Opportunities**

The reviewed literature highlights strong public support as a critical opportunity for the successful implementation of MLFF in Indonesia. User surveys demonstrate that 92% of respondents agree with contactless tolling because of its potential to shorten transaction times and eliminate queues, while 69.5% of Jabodetabek residents report being "very interested" in the system. Among the largest user group, private employees, more than half (52%) express high interest. Moreover, a majority of toll road users in Jabodetabek explicitly connect MLFF implementation to congestion reduction, reinforcing the perception of the system as a legitimate solution to one of the most pressing transport issues in the region. These findings can be interpreted through the lens of Institutional Theory, which emphasizes that organizations and policies gain legitimacy and stability by aligning with societal norms, expectations, and external pressures. High levels of public acceptance represent a normative pressure, signaling that MLFF is not only technically desirable but also socially legitimate. In this case, public support functions as a driver of institutional legitimacy, making it easier for policymakers and toll operators to justify investments and regulatory reforms. These external factors related to the implementations of MLFF have been laid out in Table 2

**Table 2.** Results of Literature Review Categorized Regarding Policy and Implementation Aspects (Opportunities & Threats)

| Category | Key Themes | Synthesized Evidence from Literature |
|---|---|---|
| Opportunities | High public support and acceptance | Survey-based studies consistently show strong public support for MLFF implementation. Approximately 92% of respondents favor contactless tolling due to reduced queues and transaction times, while 69.5% of Jabodetabek users report high interest. Major user groups, particularly private employees, also demonstrate strong adoption intentions [57], [68], [69]. |
| | Congestion mitigation in priority regions | High congestion levels and strong demand in Jabodetabek create favorable conditions for MLFF pilot implementation, positioning the region as a demonstration site that can stimulate broader national adoption through replication effects [33], [69]. |
| | Institutional legitimacy and policy momentum | Public support strengthens normative and coercive pressures on policymakers, enhancing the legitimacy of MLFF and increasing the likelihood of regulatory reform and infrastructure investment aligned with national logistics efficiency goals [30], [34]. |
| Threats | Regulatory and legal uncertainty | MLFF implementation requires substantial legal and regulatory adjustments. Existing toll road laws are not fully aligned with barrier-free tolling, and fragmented regulations may undermine enforcement legitimacy and operational consistency [34], [66]. |
| | Dependence on stakeholder coordination | Successful deployment depends on collaboration among multiple stakeholders, including ministries, toll operators, technology providers, and law enforcement agencies. Weak coordination or misaligned interests pose risks to effective implementation [33], [34] |
| | Road user readiness and socialization gaps | Despite general support, studies highlight the need for extensive public education and socialization. Limited understanding of MLFF operations and benefits may reduce compliance and adoption, particularly during early implementation stages [58], [70] |
| | Technology and infrastructure readiness risks | Variations in system reliability, interoperability of onboard units, and the absence of unified national technical standards may weaken user trust and institutional credibility if not addressed prior to large-scale rollout [33], [34]. |

Additionally, the concentration of support in the Jabodetabek region provides a strategic opportunity to use the area as a pilot zone. As the most congested urban area in Indonesia, Jabodetabek embodies both the greatest need and the strongest demand for MLFF. Institutional Theory suggests that successful implementation in such a high-profile region can create mimetic pressure, encouraging adoption in other parts of the country as policymakers and operators seek to replicate successful models. Finally, strong public support also strengthens coercive regulatory pressures. When the majority of road users demand congestion-free tolling, governments and operators face greater pressure to adopt reforms, not only to meet efficiency objectives but also to maintain legitimacy in the eyes of citizens. This alignment between public demand, policy goals, and technological capacity creates a favorable institutional environment that reduces the

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political and social risks often associated with major infrastructure reforms.

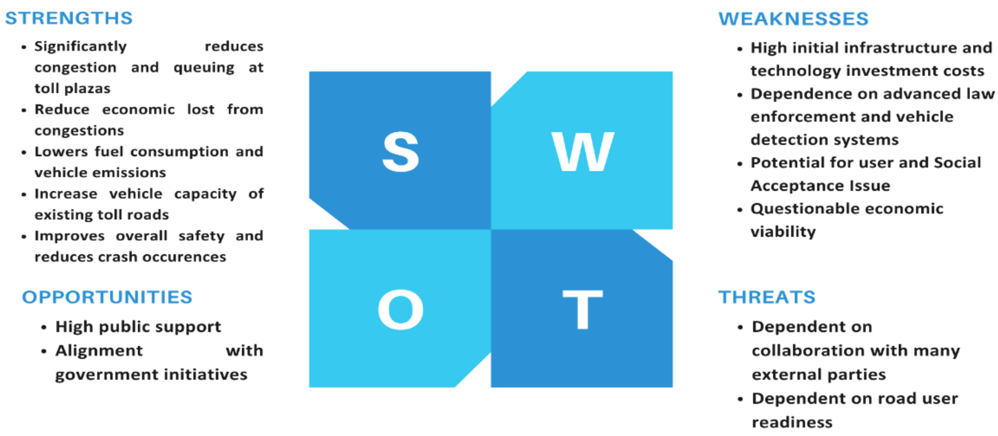
**Threats**

While the potential benefits of MLFF are well-documented as has been laid out, the literature also highlights several external threats that may hinder successful implementation in Indonesia. These threats can be understood through the lens of Institutional Theory. One major threat relates to institutional and legal uncertainty. Studies note that a comprehensive regulatory overhaul is required for MLFF, involving input from private sectors, operators, policymakers, and legal consultants. Without clear laws and updated regulations, the legitimacy of MLFF enforcement could be challenging, undermining compliance and creating legal disputes. Institutional Theory identifies this as a coercive pressure; organizations must conform to formal rules and legal standards to secure legitimacy. If these rules remain outdated or fragmented, MLFF may fail to gain full institutional acceptance.

A second threat arises from public acceptance and social legitimacy. Although surveys suggest high levels of public support in principle, other studies caution that successful implementation requires sustained socialization and education campaigns. Without adequate outreach, users may misunderstand the benefits, resist adoption, or fail to comply with requirements such as installing onboard units. Institutional Theory frames this as a normative pressure, whereby systems must align with public expectations and shared social norms. Failure to manage public perceptions and build trust could threaten long-term legitimacy, even if the technical system performs as intended.

Third, technological and infrastructure readiness presents risks to institutional credibility. Concerns remain about system reliability, interoperability of onboard units, and the lack of a unified national roadmap for technical and operational standards. If the technical system proves unreliable or inconsistent across regions, MLFF may lose legitimacy in the eyes of both users and regulators. Here, Institutional Theory points to the importance of taken-for-granted practices. A system must demonstrate stability and reliability before it becomes institutionally embedded. Finally, policy and governance risks represent a significant external threat. Effective implementation requires coordination across multiple ministries, operators, and regulators, as well as a cross-ministerial task force for oversight. Fragmented governance or conflicting stakeholder interests could slow implementation or create policy inconsistencies. Institutional Theory emphasizes that legitimacy is reinforced when actors coordinate and present a unified framework; conversely, fragmented governance undermines legitimacy and exposes MLFF to political or bureaucratic resistance. Figure 3 below presents the summary of the SWOT analysis.

**Figure 3.** Synthesized SWOT framework for multilane free-flow (MLFF) tolling implementation.




## CONCLUSION

This study demonstrates that the implementation of Multilane Free Flow (MLFF) technology holds significant potential to address Indonesia's persistent challenges in logistics and transportation efficiency. By reducing delays, queue lengths, fuel consumption, and emissions, MLFF emerges as a strategic solution that can effectively lower vehicle operating costs, whether directly or indirectly, as shown by the analysis of existing literature. Viewed through the Resource-Based View (RBV), these benefits represent valuable, rare, and hard-to-imitate resources that strengthen the competitiveness of toll operators and logistics stakeholders. At the same time, Institutional Theory (INT) highlights that the success of MLFF will depend not only on technical performance but also on public acceptance, regulatory readiness, and coordinated governance. The SWOT analysis further reveals that while MLFF offers clear strengths and enjoys high public support, it faces weaknesses related to technological accuracy, economic viability, and user acceptance, as well as external threats stemming from fragmented regulations and stakeholder coordination challenges. These findings underline the importance of aligning MLFF implementation with strong policy frameworks, reliable infrastructure, and extensive public education to ensure broad legitimacy and effectiveness. Compared to previous studies that often focused narrowly on either the technical performance of MLFF or its financial feasibility, this research provides a more holistic contribution by combining SWOT analysis with RBV and Institutional Theory. This integration allows for a deeper understanding of both the strategic resource dimension and the institutional challenges, offering a more comprehensive framework for policymakers and practitioners. Overall, MLFF represents a promising innovation for reducing vehicle operating costs and enhancing Indonesia's logistics performance. However, its long-term success will require overcoming technological and institutional barriers through cross-sector collaboration, regulatory reform, and careful transition strategies. Future research should build on these findings by quantifying direct cost savings for logistics operators and evaluating large-scale implementation scenarios, thereby strengthening the evidence base for MLFF as a sustainable national transportation poli

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