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BRIDGING THE CAPACITY GAP: A TAPIC FRAMEWORK ANALYSIS OF CARBON PRICING INSTRUMENTS FOR MALAYSIAN PALM OIL SECTOR

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ABSTRACT

The Malaysian palm oil (MPO) industry, an important economic pillar and the nation's third-largest export contributor, generating RM84.22 billion in revenue, faces escalating global pressure from sophisticated non-trade barriers (NTBs) and scrutiny of greenhouse gas (GHG) emissions. This study evaluates the complex implications of implementing carbon pricing instruments (CPIs) through a strategic governance lens, examining their economic, environmental, and social impacts within the high-stakes environment of international trade. Utilising a qualitative approach and the Transparency, Accountability, Participation, Integrity, and Capacity (TAPIC) framework, the study investigates how CPIs can resolve existing governance deficits, such as the "Participation Paradox" and the "Continuity Crisis", while enhancing market competitiveness and policy resilience. Key findings highlight that while CPIs introduce immediate cost implications for producers, they serve as a critical defensive mechanism against international regulatory shifts, such as carbon border adjustments. The analysis emphasises the necessity of the MPO Trade Governance Framework (MPO-TGF) and an enhanced Malaysian Sustainable Palm Oil (MSPO) certification to institutionalise carbon-related technical justifications within Free Trade Agreements (FTAs). Ultimately, this study highlights the transformative potential of CPIs to position MPO as a global leader in sustainable, low-carbon production, ensuring long-term national economic resilience and global competitiveness.

Keywords: carbon pricing, Malaysian palm oil (MPO), Malaysian Sustainable Palm Oil (MSPO), trade governance, TAPIC framework.

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INTRODUCTION

The Malaysian palm oil (MPO) industry stands as a vital cornerstone of the national economy, consistently ranking as the third-largest export contributor and generating substantial revenue. In the competitive global landscape of 2026, MPO and its derivatives reach over 187 countries, maintaining a dominant market share of 25.5% in global production and 43.3% in worldwide exports (Abdul Razak et al., 2024; Malaysian Palm Oil Board [MPOB], 2025; Mielke, 2017). This economic powerhouse generates significant benefits, contributing RM84.22 billion in export revenue as of 2025 (Malaysia External Trade Development Corporation [MATRADE], 2026). The sector's output is highly diversified, with palm oil accounting for 62% of exports, followed by oleochemicals (12%), palm kernel cake (9%), and palm kernel oil (4%).

However, this dominant economic position is increasingly challenged by the industry's environmental footprint, primarily stemming from land-use changes and production processes (Renner et al., 2008; Thangavelu & Yee, 2017; Zhao et al., 2024). To navigate these pressures, the Malaysian

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government has committed to ambitious climate goals under the Paris Agreement, aiming to reduce gross domestic product (GDP) carbon intensity by 45% by 2030 and achieve net-zero emissions by 2050 (Securities Commission Malaysia, 2024). Current strategies in complying with the Paris Agreement include capping total planted area at 6.5 million hectares, prohibiting new peatland plantations, and banning forest conversion (Naidu et al., 2024). Furthermore, Malaysia strives to maintain at least 50% forest cover and conserve biodiversity in alignment with the United Nation's (UN) 2030 Agenda for Sustainable Development (Malaysian Investment Development Authority [MIDA], 2024).

In this high-stakes environment, carbon pricing instruments (CPIs) have emerged as a primary mechanism to integrate environmental sustainability with economic growth. A CPI assigns a monetary value to greenhouse gas (GHG) emissions, creating financial incentives for industries to reduce their carbon output (Agnolucci et al., 2024; Stern et al., 2022; The World Bank Group, 2024). While physical carbon itself is not typically traded in these markets, carbon credits serve as tradable certificates that businesses use to account for and balance their emissions on financial statements. Each carbon credit represents the reduction or removal of one tonne of carbon dioxide (CO_2) from the atmosphere or the prevention of one tonne of CO_2 emissions (The World Bank Group, 2024). For Malaysia, carbon pricing is emerging as an important tool in addressing climate change, as demonstrated by Shahul Hamid et al. (2026), particularly for high-emission sectors like the oil palm sector (Tengku Hamzah et al., 2019).

The CPI can be implemented in various forms, including carbon taxes, cap-and-trade systems, and hybrid approaches, each balancing the trade-off between cost certainty and emissions reduction outcomes (Agnolucci et al., 2024; Voo & Chow, 2024). By assigning a cost to GHG emissions, CPIs offer opportunities for sustainable development in the MPO sector, supporting emission reductions, enhancing environmental accountability, and potentially generating new revenue streams through carbon markets (Judijanto, 2025; Tengku Hamzah et al., 2019).

Malaysia has committed to reducing its carbon emission intensity by 45% by 2030 compared to 2005 levels and aims to achieve carbon neutrality by 2050 (Rao et al., 2025; Susskind et al., 2020; Weber et al., 2024). The country has identified carbon capture and storage (CCS) as a key strategy to reduce emissions from its energy sector, with the potential to cut 60% of the sector's total emissions (Ministry of Natural Resources, Environment and Climate Change [NRECC], 2022; Nasir & Go, 2024). While these removals are primarily driven by forests, mangroves, and peatlands, the oil palm sector plays a complementary role through sustainable plantation practices, reforestation of degraded land, and adoption of good agricultural practices (GAP), thereby enhancing the country's overall carbon sequestration and climate mitigation efforts.

The Malaysian Government's Readiness Support Plan (RSP), approved by the Partnership for Market Implementation in August 2022 with support from the World Bank, signals a commitment to developing CPIs and improving stakeholder understanding. However, the specific involvement of the oil palm sector and the MPOB in these initiatives remains unclear. Malaysia's approach to carbon pricing is complex, with voluntary mechanisms under Bursa Malaysia and regionally diverse carbon pricing models that differ in design and objectives (Tengku Hamzah et al., 2019). These discrepancies create uncertainty within the oil palm sector regarding applicable policies. Moreover, regulators face challenges in evaluating and standardising these varied carbon pricing models, and imposing metrics to aggregate and compare diverse CPI frameworks (Bellassen et al., 2015; Jackson et al., 2018). This review aims to explore the policy governance mechanisms surrounding CPIs in Malaysia, particularly as they apply to the oil palm sector, and to provide policy recommendations for effectively integrating CPIs into the MPO industry to promote environmental and economic benefits.

MATERIALS AND METHODS

Materials

This study adopts a robust qualitative approach to assess the multi-dimensional implications of CPIs on the MPO sector. The study synthesises primary and secondary information from a wide array of literature, official policy documents, and industry reports spanning from 2024 to 2026. Data sources include the MPOB, MATRADE, MIDA, NRECC, the World Bank, and the Securities Commission. Key policy frameworks examined include the National Sustainability Reporting Framework (NSRF), the National Energy Transition Roadmap (NETR), and the Malaysian Sustainable Palm Oil (MSPO) certification scheme, which collectively guide current sustainability and carbon management practices.

Methodology

The methodology employs a multi-staged qualitative approach that integrates a comprehensive literature synthesis, policy document analysis, and framework application.

The literature and policy review was conducted to establish a robust evidence base, synthesising peer-reviewed journals, official national policies, and industry reports from 2024 to 2026. Key governance and socio-economic themes relating to CPIs within the palm oil sector were extracted and aggregated. Building upon this foundational data, the study utilises the Transparency, Accountability, Participation, Integrity, and Capacity (TAPIC) framework (originally developed by the European Observatory on Health Systems and Policies) as a diagnostic tool to evaluate the internal executive machinery governing Malaysia's trade and carbon policy (Jarman, 2017).

This study adapts TAPIC to evaluate the structural integrity of trade and carbon policymaking through five interrelated dimensions: Transparency, which ensures that stakeholders are informed of the grounds and processes behind upcoming decisions; Accountability, which establishes formal relationships where agencies must justify their actions to a mandate-holding forum; Participation, ensuring that affected parties, such as smallholders and technical experts, acquire a meaningful stake in the work of the institution; Integrity, which provides clear, predictable roles and enforcement processes to mitigate conflicts of interest; and Capacity, which measures the institution's ability to align resources with policy goals effectively. By applying this framework, the study distinguishes whether current trade and carbon policies are shaped by secretive, ad hoc executive actions or by inclusive, institutionalised governance.

Data segments are categorised through deductive thematic coding to identify structural governance gaps, such as the "Participation Paradox" and "Continuity Crisis," which hinder the industry's strategic defence. Furthermore, the study applies the MPO Trade Governance Framework (MPO-TGF) logic to map the implementation of carbon pricing across the three phases of the trade negotiation lifecycle: Phase 1: Pre-Negotiation (Strategic Alignment), Phase 2: Negotiation (Real-Time Coordination), and Phase 3: Implementation and Post-Negotiation (Policy Resilience). This integrated approach ensures that the findings are grounded in actual Malaysian trade diplomacy, providing insights to inform effective CPI implementation in the sector (*Figure 1*).

RESULTS AND DISCUSSION

Impact Analysis of Carbon Pricing on the MPO Industry

The implementation of CPIs in the MPO industry is anticipated to have various effects, influencing the sector's economic performance, environmental impact and social landscape. This section examines the economic, environmental, and social impacts of CPIs in the context of Malaysia's palm oil industry, as well as the role of the MSPO certification in supporting or adapting to these policies.

Economic Impact

The introduction of CPIs, such as carbon taxes and cap-and-trade systems, introduces new financial costs to emissions-intensive industries like palm oil. These operational expenses may require producers to allocate significant funds to adopt sustainable practices, invest in emissions-reducing technologies, or purchase carbon credits to offset their carbon footprint. Small-scale producers, often operating on limited budgets, may face significant hurdles in absorbing these costs (Bassi et al., 2009; Halim et al., 2019).

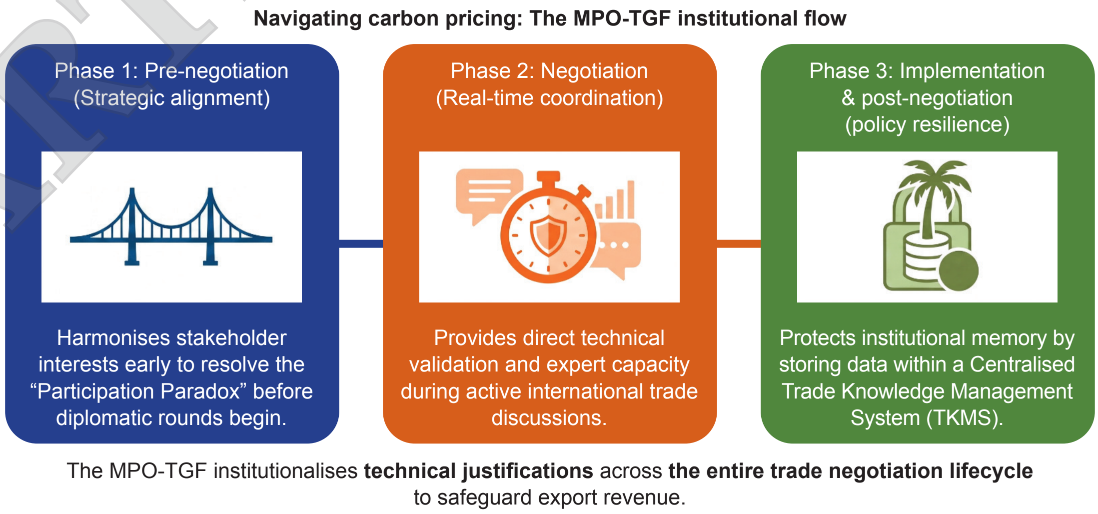

Figure 1. The customised MPO-TGF Institutional Flow.

Furthermore, CPIs are projected to fundamentally adjust the competitive positioning of the MPO in the global marketplace. As higher carbon pricing internalises the financial burden of emissions, production costs and unit prices of palm products are expected to rise, necessitating a shift in long-term pricing strategies (Mohamad, 2024). Although these increases may initially constrain competitiveness against producers in unregulated jurisdictions, the transition represents a strategic investment in trade resilience (Wettestad, 2009). In a 2026 trade landscape defined by carbon border adjustments, and sophisticated non-trade barriers (NTBs), proactive carbon reduction serves as a critical defensive mechanism to safeguard Malaysia's RM84.22 billion in export revenue.

By transitioning from traditional price-based competition to value-based advocacy, Malaysia can effectively mitigate the risks of international regulatory exclusion. Ultimately, this strategic posture enhances MPO's reputation in premium markets, such as the European Union (EU), attracting global buyers willing to pay a premium for certified, low-carbon commodities that meet high-integrity sustainability benchmarks (Tan et al., 2024).

Policy Governance and Strategic Trade Alignment

To effectively manage these economic shifts, MPO trade governance must evolve from a domestic environmental focus into a robust strategic trade defence mechanism. The current accountability structure in trade negotiations is predominantly executive-centric, which often bypasses the essential technical scrutiny of subject matter experts at the agency level when sustainability chapters in FTAs are drafted. The application of the TAPIC framework as a diagnostic tool reveals that the industry's vulnerability to international regulatory shifts is rooted in specific governance-based barriers rather than technical inability.

Transparency. Communication typically follows a "top-down cascade", creating information silos that prevent lead negotiators from accessing the granular technical data held by agencies like MPOB.

Accountability. The lack of a decentralised accountability structure means that technical justifications for carbon projects are often lost in translation during high-level diplomatic rounds.

Participation. A persistent "Participation Paradox" exists where technical experts are consulted only at the peripheries of negotiation rounds, distancing them from the critical decision points that define carbon border adjustments.

Integrity. The "Continuity Crisis," fuelled by frequent rotations of administrative personnel, leads to the erosion of institutional memory, making it nearly impossible to sustain the long-term strategic logic required for carbon sequestration and reforestation initiatives.

Capacity. Significant imbalances in technical-legal expertise hinder the ability of technical agencies to directly defend nuanced provisions within complex negotiation chapters, such as Trade in Goods (TIG).

Strategic alignment requires the operationalisation of the MPO-TGF to bridge these gaps. This framework serves as the institutional vehicle for the TAPIC pillars: Phase 1 (Pre-Negotiation) resolves the "Participation Paradox" by harmonising interests early; Phase 2 (Active Negotiation) ensures real-time technical validation and capacity; and Phase 3 (Implementation and Evaluation) solves the "Continuity Crisis" by institutionalising data within a centralised Trade Knowledge Management System (TKMS). This systematic integration ensures that Malaysia's carbon credentials are not just documented but are actively and consistently defended to protect the nation's RM84.22 billion in export revenue.

Environmental Impact

A key objective of carbon pricing is to reduce GHG emissions by encouraging industries to adopt cleaner and more sustainable practices. As highlighted by Radulescu et al. (2025), the establishment of a robust regulatory framework and strong commitment to carbon pricing are critical for ensuring consistent enforcement across all stakeholders, ultimately leading to significant positive environmental outcomes. In this context, environmental taxes, when combined with carbon pricing mechanisms and innovations such as green patents, can serve as powerful incentives for stakeholders to transition toward sustainable practices and low-emission technologies. For the MPO industry, this could mean transitioning to more sustainable land use practices, reducing deforestation and minimising emissions from production and processing activities (Sulong et al., 2021; Thangavelu & Yee, 2017; Yusop, 2022). CPIs, implemented through mechanisms such as carbon taxes and cap-and-trade systems, establish financial frameworks that incentivise firms to invest in decarbonisation technologies (Dill, 2024). These instruments facilitate the adoption of green innovations, most notably methane capture systems in palm oil mills and advanced agricultural techniques such as precision agriculture and enhanced soil management (Bharti et al., 2024).

Beyond direct GHG reductions, these transitions strengthen operational productivity through resource conservation, ultimately securing the long-term economic and environmental viability of the MPO industry. By integrating such advancements, the MPO industry can effectively align its production processes with national climate targets and international sustainability trends, ensuring its continued leadership in responsible agricultural production (Tan et al., 2024).

Malaysia has established climate targets as part of its strategic transition toward a low-carbon economy. Central to its Nationally Determined Contributions (NDCs) under the Paris Agreement is the commitment to reduce GDP carbon intensity by 45% by 2030 and achieve net-zero emissions by 2050. Given its substantial scale and contribution to national emissions, the MPO industry represents a critical area for mitigation efforts (Toh et al., 2025; Vaicondam et al., 2025). By adopting CPIs in high-emission sectors like palm oil, Malaysia can make significant progress toward these climate goals. The palm oil industry, given its scale and contribution to national emissions, represents a crucial area for emissions reduction efforts. By aligning the sector's practices with Malaysia's climate commitments, CPIs could help the country meet its international pledges, including those under the Paris Agreement. Furthermore, reducing emissions from palm oil production could enhance Malaysia's standing in the global climate arena, showcasing the country's commitment to sustainability and responsible agricultural practices (Goh et al., 2025; Sulin et al., 2025).

Social Impact

The palm oil industry supports millions of livelihoods in Malaysia, from plantation workers to smallholder farmers. CPIs could have varied effects on these stakeholders, depending on how the costs are distributed and the support provided for sustainable practices (Osman et al., 2019). For example, according to Solidaridad (2023), smallholders may face difficulties meeting the requirements for carbon reduction, as sustainable practices often require investment of time, new technologies, certifications or training. To ensure equitable outcomes, policy frameworks may need to incorporate subsidies, grants or technical assistance for smallholders and local communities to adapt to carbon policies (Mohamad, 2024). If well-managed, CPIs could foster community resilience by promoting environmentally sound practices, protecting biodiversity, and supporting sustainable livelihoods. On the other hand, if poorly managed, they could exacerbate inequalities by placing an unjustifiable burden on the most vulnerable stakeholders in the oil palm sector.

Carbon pricing could indirectly influence employment patterns in the oil palm sector. As companies invest in new technologies and practices to reduce emissions, demand for skilled workers in areas such as sustainable agriculture, emissions management and carbon accounting may increase (Hamid et al., 2024; Renner et al., 2008). Conversely, if certain practices or processes become economically unviable under CPIs, employment in those areas may decline, potentially leading to shifts in the workforce. Ensuring a just transition for workers may require policy support for retraining and upskilling programs, preparing the workforce for roles that align with a low-carbon economy. These measures could help mitigate adverse employment impacts and ensure that the benefits of CPIs are widely shared among workers and communities (Errendal et al., 2023).

Impact on the MSPO Certification

The MSPO certification, which sets standards for sustainable practices in palm oil production, could play an essential role in aligning the industry with carbon pricing policies. As MSPO certification already promotes environmentally responsible practices, it could serve as a foundation for the integration of carbon policies, helping producers align with CPIs' requirements more seamlessly (Sulong et al., 2021; Yusop, 2022). The MSPO framework could be adapted to include carbon management practices, thereby reducing emissions and supporting compliance with national carbon reduction goals. For instance, MSPO could establish guidelines on emissions monitoring, reporting and verification for carbon credits, assisting producers in tracking their emissions and participating in carbon markets.

Furthermore, MSPO certification could bolster the market appeal of MPO by highlighting the sector's commitment to both sustainable and low-carbon practices. This would be particularly advantageous in international markets where buyers prioritise environmentally certified products. However, incorporating carbon criteria into MSPO may also impose additional training and financial resources for smallholders and smaller producers, who may struggle to meet the enhanced standards. Addressing these challenges may require capacity-building programs, financial assistance or incentives to support widespread adoption of the enhanced MSPO certification.

With MSPO emphasising a low-carbon footprint, it could significantly enhance the consumer appeal of Malaysian palm products by adapting to growing market demands for sustainable, environmentally friendly products. Aligning MSPO standards with consumer preferences for low-carbon commodities adds a critical consumer-centric proposition to the certification's objectives. The alignment not only reinforces the sustainability narrative of Malaysian palm-based products but also enhances its reputation and competitiveness in global markets where environmental credentials are highly recognised.

To capitalise on these opportunities, the oil palm sector should prioritise international market demands for low-carbon products by incorporating targeted strategies within the MSPO framework. This could consist of consumer awareness campaigns showcasing the low-carbon credentials of MSPO-certified palm oil. Such initiatives could leverage the industry's global reputation and strengthen its market positioning as a leader in sustainable and low-carbon palm oil production.

The potential impacts of CPIs on the MPO sector extend beyond emission reduction objectives and involve various economic, environmental, operational and social considerations. These multi-dimensional impacts synthesised from qualitative analysis of TAPIC governance dimensions, MSPO standards and Malaysian trade policy objectives are summarised in *Table 1*.

Challenges and Barriers to Implementing CPIs in MPO Industry

Despite the strategic benefits, implementing CPIs in the MPO industry faces multi-dimensional barriers spanning political, economic, social, institutional and infrastructural dimensions. While Malaysia's carbon governance framework increasingly aligns with international standards like the International Sustainability Standards Board (ISSB), institutional predicaments, notably the absence of a unified regulatory framework and coordination gaps between lead agencies, complicate policy alignment.

As illustrated in *Figure 2*, the barriers hindering the effective implementation of CPIs in the MPO industry span five interconnected dimensions.

Political. The implementation of CPIs requires strong governmental commitment and policy consistency, which can be challenging in the face of competing priorities. Policymakers must balance environmental goals with economic growth and industry support, especially since the oil palm sector is a significant contributor to Malaysia's GDP and employment. Any policies perceived as increasing operational costs or reducing competitiveness can face resistance, not only from industry stakeholders but also from political parties concerned with economic growth. Additionally, political pressures from rural communities reliant on the palm oil industry, along with lobbying from large corporations, can further complicate efforts to enforce stringent carbon policies.

TABLE 1. MULTI-DIMENSIONAL IMPACT MATRIX OF CARBON PRICING INSTRUMENTS (CPIS) ON THE MALAYSIAN PALM OIL (MPO) SECTOR

Impact dimension	Key opportunities/strategic benefits	Primary operational and financial risk	Recommended governance and policy mitigation
Economic	Potential premium pricing in the EU and other global markets; stronger trade defence against NTBs and carbon border adjustment measures.	High initial operational and compliance costs; possible price disadvantage relative to producers in less regulated jurisdictions.	Shift from price-based competition to value-based advocacy; operationalise the MPO-TGF to support market access and trade resilience.
Environmental	Decarbonisation through methane capture, precision agriculture, and improved resource efficiency; stronger alignment with Paris Agreement targets.	Risk of greenwashing if carbon offsets are used without prioritising direct emissions reductions.	Adopt science-based targets that prioritise internal decarbonisation before using high-integrity offsets for residual emissions.
Social	Creation of new employment opportunities in sustainable agriculture, carbon accounting, emissions management, and green technologies.	Disproportionate financial burden on smallholders; potential displacement or reskilling needs among workers in traditional roles.	Provide targeted subsidies, grants, technical assistance, capacity-building, and retraining programmes to support a just transition.
MSPO certification	Enhanced international market appeal; stronger platform for carbon accounting, monitoring, reporting, and verification.	Financial and technical barriers may limit smallholder readiness and compliance with enhanced carbon-related requirements.	Integrate carbon criteria into MSPO standards while providing targeted support to strengthen smallholder participation and compliance.

Note: EU - European Union; NTBs - non-trade barriers; MPO-TGF – Malaysian Palm Oil-Trade Governance Framework; MSPO - Malaysian Sustainable Palm Oil.

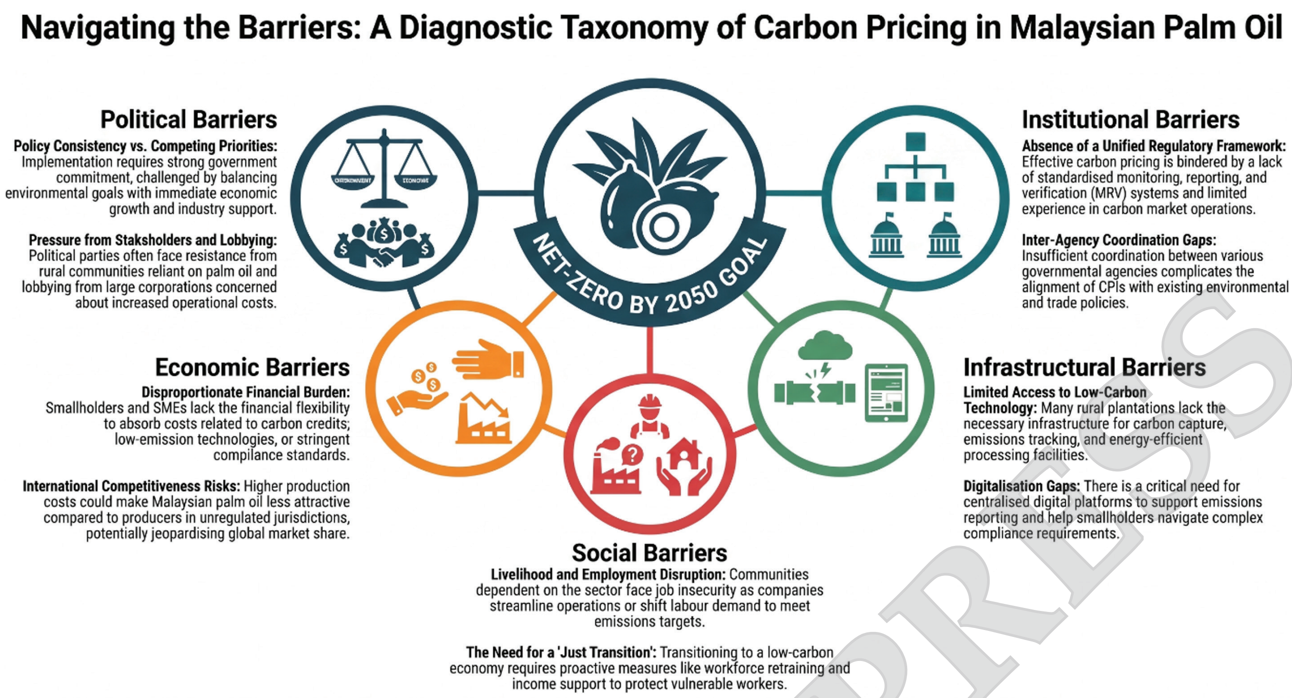

Figure 2. Diagnostic Taxonomy of Implementation Barriers.

Economic. CPIs introduce new financial challenges for palm oil producers, particularly smallholders and small and medium-sized enterprises with limited financial flexibility. The expenses associated with acquiring carbon credits, adopting low-emission technologies or meeting stringent compliance standards could disproportionately affect these smallholders, aggravating inequalities within the sector (Radulescu et al., 2025). Larger corporations, with their greater financial capacity, are better positioned to manage these costs, potentially passing them onto consumers or leveraging economies of scale. Additionally, the introduction of carbon-related costs risks diminishing Malaysia's international competitiveness in the palm oil market. Higher production costs could make MPO less attractive compared to producers in countries without similar carbon pricing frameworks, potentially jeopardising market share and revenue streams.

Social. CPIs could reshape the dynamics of local communities and the workforce in the palm oil industry. Communities that depend heavily on the sector for employment and income may face disruptions as companies adapt their operations to meet emissions targets. Financial pressures from carbon pricing could prompt some companies to streamline operations, potentially leading to reduced employment opportunities or shifts in labour demand. This poses risks of job insecurity and income instability, particularly for vulnerable workers in the industry. Addressing these social challenges will require proactive measures, such as workforce retraining programs, income support mechanisms, and policies to ensure a just transition that safeguards livelihoods while promoting low-carbon practices.

Institutional. Pose significant challenges to the effective implementation of CPIs in Malaysia. Effective carbon pricing requires a well-established framework for monitoring, reporting and verification of emissions, as well as regulatory oversight to ensure compliance. Currently, the absence of a unified regulatory framework for CPIs in Malaysia, along with limited experience in carbon market operations, hinders efficient policy enforcement. Additionally, there may be insufficient coordination between governmental agencies, which further complicates the alignment of CPIs with existing environmental policies.

Infrastructural. Implementing CPIs also requires significant infrastructural investments to support low-carbon technologies and sustainable practices in the palm oil sector. Many smallholders and local producers lack access to technology, training and financial resources needed to adopt emissions-reducing practices. The lack of infrastructure for carbon capture, emissions tracking and energy-efficient processing facilities creates additional obstacles, particularly for rural plantations. Without substantial support for technological upgrades and infrastructural development, these producers may struggle to meet the requirements of a carbon pricing regime.

Digital monitoring tools can enhance the MPO industry's capacity for carbon accounting and compliance with CPIs. Developing a centralised digital platform for emissions reporting can increase transparency and aid smallholders in navigating reporting requirements. Digitalisation addresses infrastructural and institutional barriers, particularly regarding monitoring, reporting and compliance. Insights on digital tools can enhance discussions about overcoming barriers to CPIs implementation.

Recommendations for Policy Enhancement

As a primary corrective measure, MPOB should spearhead the industry-wide deployment of cost-effective carbon reduction technologies, thereby scaling sustainable practices across the palm oil value chain. This intervention is crucial to facilitate more equitable participation in CPIs for both smallholders and large corporations, while simultaneously aligning the sector with shifting global sustainability mandates. Ultimately, this technological integration safeguards the environment while unlocking supplemental revenue streams through international carbon markets (Romito et al., 2024; Stern et al., 2022).

A critical component of this strategy is the adoption of the Science-Based Targets initiative (SBTi), which encourages organisations to set emission reduction goals aligned with the Paris Agreement's 1.5°C target (Romito et al., 2024). By prioritising internal decarbonisation before turning to carbon credits as a secondary measure, businesses avoid "greenwashing" concerns and demonstrate a genuine commitment to science-driven climate action. After significant direct reductions are achieved, high-integrity carbon credits can then be utilised to offset residual emissions, thereby strengthening environmental credibility within a responsible climate strategy (Bernasconi, 2021; Chu & Yuan, 2025; Maloney & Busch, 2024).

If a company were to purchase carbon credits without prioritising internal reductions, it might appear as though they are addressing the issue, but this approach does not tackle the core problem: The direct emissions generated by their activities. This can raise concerns about "greenwashing," where an organisation is perceived as offsetting emissions rather than committing to real, sustainable changes. By following the SBTi framework, businesses demonstrate that they are taking meaningful, science-driven steps toward decarbonisation. After significant reductions have been achieved, carbon credits can be used to offset any remaining emissions that are difficult to eliminate. This method not only strengthens a company's environmental credibility but also ensures that carbon credit purchases are part of a broader, more responsible climate strategy.

However, the effectiveness of CPIs in the agricultural sector remains dependent on careful policy design to address sector-specific hurdles such as high transaction costs and leakage risks. Consequently, Malaysian policies must integrate science-based targets with targeted support mechanisms including subsidies, grants, and capacity-building programs to ensure a "Just Transition" for the workforce. While certain traditional processes may become economically unviable, these shifts simultaneously create new demand for skilled labour in specialised fields like carbon accounting and emissions management (Grosjean et al., 2018; Tvinnereim & Mehling, 2018).

Integrating the MPO-TGF logic into social policy is vital to resolving the "Participation Paradox" by ensuring smallholders and local communities have a "meaningful stake" in the decision-making process during Phase 1 (Pre-Negotiation) of CPI implementation. By fostering community resilience and protecting biodiversity through well-managed governance, Malaysia can ensure that the economic benefits of a low-carbon economy are shared rightfully across the entire palm oil supply chain.

The roadmap outlined in *Figure 3* presents a three-phased operational trajectory for transitioning the MPO industry into a resilient, low-carbon sector. Phase 1 focuses on upstream direct emissions reduction using the SBTi framework alongside circular economy practices. Phase 2 institutionalises these practices by updating MSPO standards with digital Measurement, Reporting, and Verification (MRV) mechanisms designed to protect smallholders from exclusion. Finally, Phase 3 leverages the MPO-TGF and a centralised TKMS to systematically defend Malaysia's carbon credentials in international trade negotiations and neutralise prospective carbon border taxes.

Prospects and Innovations for MPOB

MPOB has identified significant interest from various stakeholders in carbon project initiatives within the oil palm sector, aimed at offsetting emissions or trading credits in emerging markets. To capitalise on these opportunities, the board focuses its advocacy on three nature-based and innovation-driven pathways: reforestation within plantation areas, replanting of high-yielding varieties and circular economy initiatives in the downstream industry. These projects serve to enhance carbon sequestration while aligning the sector with Malaysia's GHG reduction targets and international sustainability trends.

Reforestation and Upstream Carbon Management

Reforestation within oil palm plantations represents a promising approach to maximising the industry's carbon capture capacity by rehabilitating underutilised or degraded land into

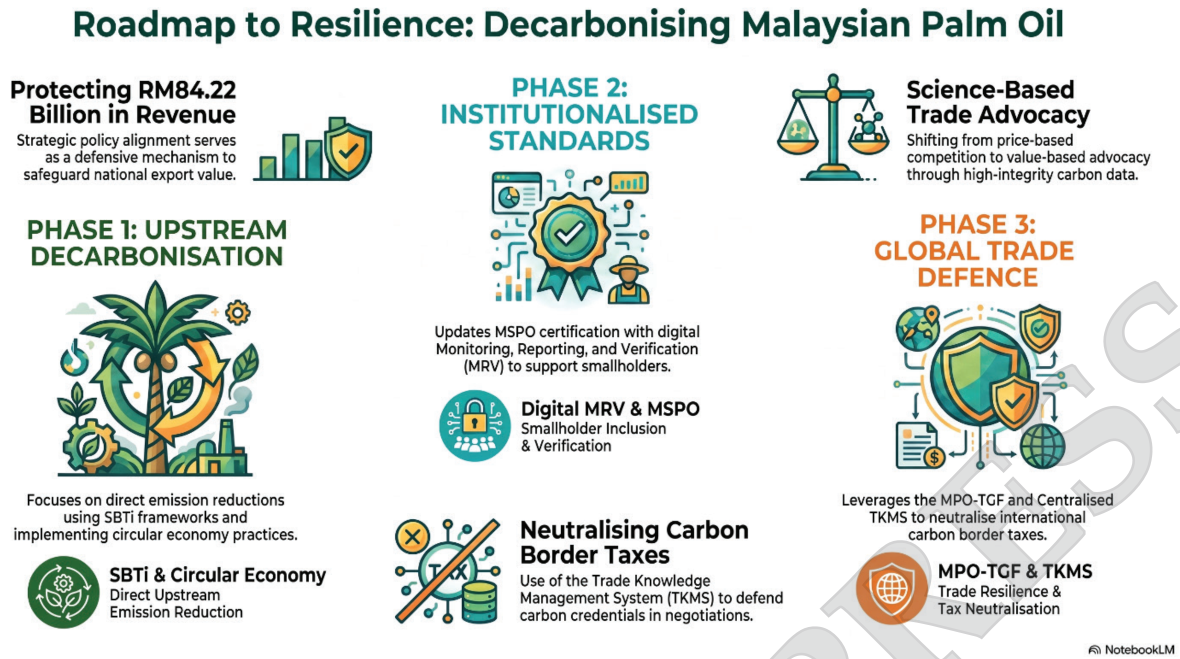

Figure 3. Strategic Decarbonisation and Policy Resilience Roadmap for the Malaysian Palm Oil (MPO) Sector.

forest ecosystems. As these forests serve as long-term carbon sinks, they store significant carbon in biomass and soil while delivering critical co-benefits such as biodiversity conservation. From an economic perspective, the carbon credits generated through these reforestation efforts can be traded in voluntary carbon markets, offering plantation operators a diversified revenue stream that reinforces the industry's reputation as a sustainable contributor to global climate goals.

Replantation Strategies and Technical Additionality

Replantation projects, particularly the replacement of ageing oil palm trees with younger, high-yielding varieties, offer a dual benefit of improving plantation productivity and enhancing ecosystem health. Efforts that incorporate diversified cropping systems, such as intercropping with other trees, further reduce the carbon footprint of oil palm cultivation. Improved land management and soil quality contribute to the "additionality" criteria required in carbon projects, making downstream products significantly more attractive to international buyers prioritising low-carbon commodities.

Circular Economy Models in the Downstream Industry

To complement upstream carbon reduction, MPOB drives circular economy projects downstream by promoting waste recycling, and byproduct utilisation. Transforming byproducts like empty fruit bunches (EFB) and palm oil mill effluent (POME) into bio-based products or energy sources minimises waste and adds value to the supply chain. Furthermore, study into biodegradable packaging for palm oil products opens new markets and reinforces the industry's commitment to sustainable lifecycle management, providing new revenue streams while improving environmental credentials.

Strategic Integration and Policy Resilience

Within the proposed MPO-TGF, these innovations are essential components of Phase 3: Implementation and Post-Evaluation (Policy Resilience). By institutionalising the data and strategic logic of these reforestation and circular projects within a centralised TKMS, the industry can safeguard its environmental technical justifications against the risks of personnel turnover. This structural approach ensures that Malaysia's carbon sequestration potential is consistently leveraged as a competitive advantage in global trade negotiations.

CONCLUSION

This study evaluates the policy governance mechanisms surrounding CPIs in the MPO sector, identifying that the primary challenges to a sustainable transition are structural and governance-based rather than only technical. The study confirms that while the industry remains a dominant economic powerhouse, it is increasingly vulnerable to sophisticated global NTBs and carbon border adjustments due to existing governance deficits.

By applying the TAPIC framework, the analysis identifies critical gaps, specifically the "Participation Paradox" and the "Continuity Crisis", which deter the industry's ability to defend its technical environmental interests during high-stakes trade negotiations. To ensure policy resilience and long-term global competitiveness, this article emphasises the necessity of the MPO-TGF. This three-phased institutional approach allows for the systematic integration of technical subjects, such as reforestation, replanting, and circular economy data, within a centralised TKMS to safeguard institutional memory.

MPOB holds a fundamental role in steering the industry toward a low-carbon future by actively encouraging stakeholders to engage in nature-based solutions that align with Malaysia's commitments under the Paris Agreement and the goal of net-zero emissions by 2050. From an economic perspective, the strategic implementation of CPIs presents transformative opportunities to unlock new revenue streams through tradable carbon credits, enhancing competitiveness in markets where low-carbon products are prioritised.

To facilitate this dynamic transition, MPOB is uniquely positioned to adopt a comprehensive and inclusive approach, implementing capacity-building programs, and establishing financial incentives to ensure equitable access for smallholders. Aligning these efforts by integrating robust carbon management practices into the MSPO 2022 certification framework is critical for reinforcing Malaysia's commitment to environmental stewardship and future-proofing the sector against evolving regulatory requirements. Ultimately, by addressing compliance barriers and leveraging innovations, the MPO industry can solidify its position as a global leader in sustainable agriculture, securing its long-term viability and contributing significantly to national climate ambitions.

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