



Regulatory Performance and Supply Chain Resilience in the Agrofood Sector: An Integrated Governance Perspective

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ABSTRACT

The agrofood sector has become increasingly vulnerable to supply chain disruptions, regulatory fragmentation, market manipulation, compliance weaknesses and rising public expectations for food security. These challenges show that food security is not only a matter of production capacity, but also a question of how effectively regulatory systems coordinate, monitor and respond across the agrofood value chain. Existing studies on agrofood supply chains often emphasise productivity, logistics, sustainability and market access, while less attention has been given to the role of regulatory performance in strengthening supply chain resilience. This paper develops an integrated governance perspective that links regulatory coordination, compliance intelligence, performance measurement and adaptive resilience in the agrofood sector. Using Malaysia as a contextual reference, the paper discusses how fragmented enforcement mandates, uneven digital integration, inconsistent performance indicators and limited end-to-end supply chain visibility can weaken regulatory effectiveness. The paper proposes a conceptual framework that positions regulatory performance as a strategic capability for improving agrofood resilience. The framework suggests that resilient agrofood systems require not only efficient industry actors, but also coordinated regulatory institutions that can share information, assess risk, measure outcomes and support timely corrective action.

Keywords: Agrofood sector; supply chain resilience; regulatory performance; integrated governance; compliance management.

INTRODUCTION

The agrofood sector plays a fundamental role in national development because it supports food availability, economic activity, public health and social stability (FAO, 2023). A reliable agrofood system depends on the ability of farmers, processors, distributors, regulators and consumers to operate within a coordinated value chain. In recent years, agrofood systems across many countries have faced pressure from climate uncertainty, disease outbreaks, labour constraints, price volatility, import dependency and geopolitical disruption (Sutar et al., 2026; Zhao et al., 2024). These pressures have exposed weaknesses not only in production and logistics, but also in the regulatory systems that oversee food movement, safety, quality and market discipline. When regulatory systems are unable to respond quickly or consistently, disruptions can spread across the supply chain and affect public confidence. Therefore, the resilience of the agrofood sector must be understood as both an operational and governance issue. This paper argues that regulatory performance is a central but underdeveloped component of agrofood supply chain resilience.

Supply chain resilience refers to the ability of a system to anticipate, absorb, respond to and recover from disruption while maintaining core functions (Ponomarov & Holcomb, 2009; Pettit et al., 2019). In the agrofood context, resilience is particularly important because food products are perishable, time-sensitive and closely linked to public welfare. A delay in inspection, a weak licensing process, a failure to detect non-compliance or poor coordination between agencies can have consequences beyond administrative inefficiency. Such



weaknesses may lead to shortages, unsafe products, higher costs, market manipulation or loss of trust. The agrofood supply chain therefore requires more than private sector efficiency and logistical capability (Christopher, 2016). It requires a regulatory environment that is coordinated, intelligence-driven and able to measure performance in terms of outcomes. This is especially important for developing economies, where institutional fragmentation and resource constraints may limit the effectiveness of enforcement delivery (Zhang & Yang, 2025).

Regulatory performance refers to the ability of regulatory institutions to deliver enforcement and compliance functions effectively, efficiently, consistently and accountably. In many public sector settings, regulatory performance is measured through activity-based indicators such as number of inspections, number of licences issued, number of compounds imposed or number of enforcement operations conducted (OECD, 2018). Although these indicators are useful, they do not fully explain whether enforcement has improved compliance, reduced risk or strengthened supply chain resilience. A more meaningful approach requires regulators to examine how their actions contribute to broader outcomes such as reduced leakage, improved traceability, faster response, lower duplication and higher stakeholder confidence. In the agrofood sector, this means looking at regulation as part of the supply chain rather than as a separate administrative function. Regulatory performance should therefore be embedded into the governance of the entire agrofood value chain. This paper develops that argument through an integrated governance perspective.

The purpose of this paper is to propose a conceptual framework linking regulatory performance and agrofood supply chain resilience. The paper is positioned within the fields of supply chain governance, management accounting and public sector performance management. It is relevant to supply chain management and performance measurement scholarship because it connects organisational coordination, sustainability, compliance and governance in a policy-relevant sector. The article uses Malaysia as a contextual reference because Malaysia's agrofood sector illustrates how complex regulatory mandates, multiple agencies and supply chain vulnerabilities can affect food security outcomes. However, the paper is not written as a consultancy report or a direct extraction from any policy document. Instead, it develops an academic argument that can be further tested through empirical research. The paper contributes by proposing an integrated model that can guide future studies on regulatory performance, compliance systems and agrofood resilience.

LITERATURE REVIEW

Agrofood supply chain resilience has received growing attention in management and sustainability research (Sutar et al., 2026; Zhao et al., 2024). Resilience is commonly associated with flexibility, visibility, collaboration, redundancy and adaptability (Zhang & Yang, 2025). In agrofood systems, these qualities are needed because disruptions can emerge from biological, environmental, economic and institutional sources. For example, crop disease, livestock infection, port congestion, sudden import restrictions or changes in consumer demand can affect the flow of food from production to consumption. A resilient supply chain should be able to identify risk early, adjust operations and restore stability with minimum damage. However, resilience should not be viewed only from the perspective of firms and logistics providers. Public institutions also shape resilience through inspection, licensing, enforcement, information systems, standards and market regulation. Evidence from the public sector reinforces this point. A study of Chinese public hospitals, for instance, found that supply chain management capabilities such as leadership and digital technology improved organisational resilience, partly through stronger risk control capability (Zhang et al., 2024). This suggests that supply chain capability and resilience are closely connected in public service settings, not only in commercial firms.

Supply chain governance refers to the mechanisms through which actors coordinate responsibilities, manage interdependence and align behaviour across the value chain (Gereffi et al., 2005). In the private sector, governance may involve contracts, standards, supplier evaluation, performance monitoring and relationship management. In the agrofood sector, governance is more complex because it involves both business actors and public regulators. Producers and distributors are responsible for operational performance, while regulators are responsible for ensuring that rules are followed and public interests are protected. When these functions are aligned, the supply chain becomes more transparent and responsive. When they are fragmented, supply chain risks become harder to detect and manage. Therefore, agrofood resilience depends on the quality of both market governance and regulatory governance. Recent evidence also suggests that supply chain governance, combined



with digital supply chain capability, can strengthen firm-level performance, which indicates that governance and digital integration are closely linked in shaping supply chain outcomes (Jia et al., 2025).

Regulatory governance is concerned with how rules are designed, implemented, monitored and enforced. Good regulatory governance requires clarity of mandate, proportionality, transparency, accountability and coordination (OECD, 2018). In fragmented systems, agencies may operate under separate laws, procedures, databases and enforcement priorities. This may create duplication, inconsistent interpretation and delays in decision-making. It may also increase compliance costs for industry players, especially small and medium enterprises that have limited administrative capacity (World Bank, 2020). From a supply chain perspective, fragmented regulation reduces visibility and weakens the ability to track risks across the value chain. For this reason, regulatory governance should be treated as a core element of supply chain resilience rather than a separate institutional matter.

Performance measurement is another important concept in this paper. Management accounting literature highlights that performance measures influence behaviour, decision-making and accountability (Franco-Santos et al., 2012). In public sector regulation, performance indicators can help agencies evaluate whether enforcement activities are achieving intended outcomes. However, the design of these indicators is critical. If agencies focus only on activity counts, they may appear productive without necessarily improving compliance or resilience. For example, a high number of inspections does not automatically mean that supply chain risks are being reduced. A stronger performance system should combine input, process, output and outcome indicators. This concern is not only theoretical. Case evidence from a Malaysian manufacturer shows that, although management accounting tools were widely used, efforts to measure and monitor supply chain performance holistically remained limited (Kasim et al., 2010). This illustrates how performance measurement can stay narrow even where supply chain coordination is otherwise well developed.

Compliance intelligence refers to the use of information, data analytics, risk profiling and stakeholder feedback to support enforcement decisions. Traditional enforcement may rely heavily on routine inspections and manual reporting. However, modern agrofood systems require regulators to use integrated data to identify high-risk actors, products, locations and transactions (Ding et al., 2025; Sutar et al., 2026). Compliance intelligence can improve regulatory targeting by helping agencies focus their resources on areas with the highest risk. It can also support early warning systems and reduce dependence on reactive enforcement. In supply chain terms, compliance intelligence strengthens visibility and allows regulators to respond before problems become systemic. Therefore, it is a key link between regulatory performance and supply chain resilience.

Malaysia Scenario: Agrofood Governance and Supply Chain Vulnerability

Malaysia provides a useful context for examining the relationship between regulatory performance and agrofood supply chain resilience. The agrofood sector is strategically important because it supports food security, rural development, household welfare and national economic stability (Ministry of Agriculture and Food Security, 2021). However, the sector is also exposed to structural challenges such as import dependency, uneven production capacity, price volatility, subsidy leakage, disease risks and fragmented enforcement arrangements (Rozhan, 2025; Tey, 2010). The national discussion on agrofood regulatory reform shows that Malaysia's agrofood regulatory and enforcement functions have historically been distributed across several agencies with different mandates. These agencies cover areas such as agriculture, veterinary services, fisheries, quarantine, marketing, padi and rice, and fisheries development. While specialisation allows each agency to develop technical expertise, it can also create coordination problems when risks cross institutional boundaries. This situation is particularly challenging because agrofood products move through interconnected stages from farm, port and processing facility to wholesale, retail and consumer markets.

One major issue in the Malaysian scenario is the separation of regulatory functions across different agencies and legal instruments. When different agencies have different powers, procedures and data systems, enforcement may become uneven across subsectors. For example, the monitoring of imported products, local production, licensing, sampling, movement control and market practices may involve different authorities at different stages. If information does not flow smoothly across these authorities, regulators may struggle to detect patterns of non-compliance that cut across the supply chain. This can lead to delayed response, repeated reporting by



complainants and uncertainty among industry players about which agency has authority over a particular issue. Such uncertainty reduces regulatory efficiency and may weaken compliance behaviour. From a supply chain governance perspective, this indicates a lack of end-to-end visibility.

The Malaysian agrofood sector has also faced public concern over issues such as rice supply, import controls, product mislabelling, subsidy claims and illegal movement of agrofood commodities. These issues show that regulatory weaknesses can have direct implications for consumer welfare and market confidence. The country's heavy reliance on imports illustrates this exposure, as the value of food imports roughly doubled from about RM42.6 billion in 2014 to RM78.8 billion in 2023 (Department of Statistics Malaysia, 2024), and rice supply remains concentrated among a small number of exporting partners (Ministry of Agriculture and Food Security, 2025). When exporting countries adjust their own trade policies, such as the rice export restrictions imposed by India, domestic prices and availability can be affected quickly (Rozhan, 2025). When supply chain actors manipulate stock, misrepresent products or fail to comply with import requirements, enforcement agencies must be able to respond quickly and decisively. If the response is slow or fragmented, the impact may spread to prices, availability and public trust. The MAREA study also identifies challenges related to complaints management, digital integration, post-entry monitoring and enforcement coverage beyond initial inspection points. These are not merely administrative weaknesses. They represent supply chain vulnerabilities because risks may continue after goods have passed through one checkpoint or one agency process.

Another important Malaysian issue is digital integration. Complaint channels and enforcement information are often separated by agency, with different formats, processes and follow-up mechanisms. This limits the ability to develop a single view of agrofood risks. In a resilient supply chain, regulators should be able to connect information from licensing, inspection, complaints, sampling, import records, enforcement actions and industry profiles (Ding et al., 2025). Without such integration, each agency may only see part of the risk picture. This can make enforcement reactive rather than preventive. It can also make performance measurement difficult because national-level outcomes cannot be easily assessed when data are scattered across separate systems.

The Malaysia scenario also illustrates the importance of human resource capability and organisational design. Effective agrofood enforcement requires officers who understand technical product risks, legal procedures, investigation methods, stakeholder engagement and digital tools. If agencies operate with different competency standards, career structures and enforcement cultures, coordination becomes more difficult. The reform discussion has highlighted the need for more systematic competency development, including basic training, sector-specific strengthening and cross-sector enforcement capability. This is important because agrofood risks are increasingly complex and may involve multiple products, regions and regulatory domains. A resilient regulatory system therefore needs not only legal authority, but also skilled personnel and consistent operating procedures. Human resource capability is thus part of regulatory performance.

Malaysia's experience suggests that agrofood resilience cannot be achieved solely through production incentives or market intervention. It also requires a governance system that can connect agencies, data, enforcement powers and performance indicators. The proposed establishment of a more integrated agrofood regulatory and enforcement authority reflects a broader policy direction toward coordinated regulatory delivery (Ministry of Agriculture and Food Security, 2021, 2025). From an academic perspective, this development provides an opportunity to examine how regulatory integration may influence supply chain resilience. It also raises important research questions about the design of performance measures, the role of digital platforms, the balance between centralisation and technical specialisation, and the impact of regulatory reform on industry compliance. These issues are relevant not only to Malaysia, but also to other developing economies facing similar agrofood governance challenges. Therefore, Malaysia serves as a meaningful contextual case for developing a broader integrated governance framework.

PROPOSED CONCEPTUAL FRAMEWORK

This paper proposes an integrated governance framework consisting of four main dimensions: regulatory coordination, compliance intelligence, performance measurement and adaptive supply chain resilience. Regulatory coordination refers to the alignment of mandates, procedures, roles and enforcement priorities across agencies involved in the agrofood value chain. Compliance intelligence refers to the use of integrated data, risk



profiling, complaints information and early warning indicators to support enforcement decisions. Performance measurement refers to the use of indicators that assess not only activities, but also outcomes and system-level improvements. Adaptive supply chain resilience refers to the ability of the agrofood system to respond to disruption, maintain continuity and improve after regulatory or market shocks. These four dimensions are interrelated and should be treated as a system rather than separate administrative components. The framework is designed to support both academic analysis and practical policy evaluation.

The framework suggests that regulatory coordination is the foundation of integrated governance. Without coordination, agencies may continue to work within their own institutional boundaries even when risks move across the supply chain. Coordination enables regulators to clarify responsibilities, reduce duplication and support consistent enforcement. It also gives industry players greater certainty about compliance requirements. However, coordination must not be interpreted as simple administrative merger. It should involve shared decision-making, common operating procedures and integrated performance expectations. In this sense, coordination is a managerial capability that supports both enforcement effectiveness and supply chain resilience.

Compliance intelligence strengthens the framework by enabling regulators to act based on risk rather than routine alone. In agrofood systems, not all products, actors or locations carry the same level of risk. A risk-based approach allows regulators to allocate resources more effectively and intervene earlier. Integrated data can help identify suspicious patterns, repeated non-compliance, high-risk entry points and sectors requiring closer monitoring. Public complaints can also become valuable intelligence if they are captured in a structured and centralised system. When compliance intelligence is strong, enforcement becomes more preventive, targeted and evidence-based. This improves the ability of the supply chain to withstand disruption.

Performance measurement provides the accountability mechanism within the framework. Regulators need indicators that show whether coordination and intelligence actually improve outcomes. Traditional measures such as inspection numbers and enforcement cases should be retained, but they should be complemented with indicators that reflect system performance. These may include average response time, percentage of cases resolved across agencies, reduction in repeated offences, level of data completeness, industry compliance improvement and stakeholder confidence. Performance measurement also supports learning because it allows regulators to identify which interventions are effective. In this way, measurement becomes more than reporting. It becomes a tool for governance improvement.

Adaptive supply chain resilience is the outcome of the framework. A resilient agrofood supply chain is able to absorb shocks, respond to risks and maintain public confidence. When regulatory coordination is weak, intelligence is limited and performance measurement is narrow, resilience becomes difficult to achieve. Conversely, when regulators share information, act on risk and measure outcomes, they strengthen the ability of the entire supply chain to function under pressure. Adaptive resilience also implies continuous improvement. Regulatory institutions should learn from disruptions, update procedures and strengthen future readiness. Therefore, resilience is not a static condition, but an evolving governance capability.

Table 1. Integrated Governance Framework for Agrofood Regulatory Performance

Dimension	Main Meaning	Example of Practical Focus	Link to Resilience
Regulatory coordination	Alignment of agencies, mandates and procedures	Shared protocols, joint operations, clear authority	Reduces duplication and response delays
Compliance intelligence	Use of data and risk-based information	Integrated complaints, risk profiling, early warning	Improves detection and prevention



Performance measurement	Assessment of outputs and outcomes	Compliance rate, response time, leakage reduction	Strengthens accountability
Adaptive resilience	Ability to respond, recover and improve	Continuity of supply, corrective action, learning	Builds long-term system stability

DISCUSSION

The proposed framework highlights the need to reposition regulatory performance as a strategic element of agrofood supply chain management. In many discussions, supply chain performance is associated mainly with cost, speed, quality and delivery reliability. However, in the agrofood sector, regulatory performance also affects supply chain outcomes because it shapes compliance, product safety, market order and public trust. Weak regulation can create hidden costs through delays, duplication, leakage and loss of confidence. Strong regulation can support resilience by improving visibility, discouraging non-compliance and enabling timely corrective action. This is particularly important in food systems because risks can quickly become public issues. Therefore, agrofood supply chain management should include regulatory capability as part of its resilience architecture.

For policymakers, the framework suggests that regulatory reform should focus on outcomes rather than structure alone. Establishing a new agency, committee or coordination mechanism will not automatically improve resilience unless it is supported by clear performance measures and integrated information systems. Policy reform should define what improved regulatory performance means in measurable terms. These measures should include efficiency, effectiveness, consistency, transparency and contribution to food security outcomes. Policymakers should also ensure that regulatory systems reduce unnecessary compliance burdens while maintaining strong enforcement against high-risk behaviour. This balance is important because overly complex regulation can discourage compliance, while weak regulation can encourage opportunistic behaviour. A well-designed regulatory system should be firm, fair and intelligence-driven.

For regulators, the framework emphasises the importance of moving from activity-based enforcement to risk-based and outcome-based enforcement (OECD, 2018). Activity-based enforcement may show that work has been done, but it may not show whether risks have been reduced. Regulators should therefore develop dashboards and reporting systems that connect enforcement activities with compliance trends and supply chain outcomes. For example, inspection data should be linked with complaints, licensing, import records and enforcement history. This would allow regulators to identify recurring patterns and make better decisions. Regulators should also strengthen feedback loops between headquarters and field officers. Such feedback loops can help convert operational experience into policy learning.

For industry stakeholders, integrated regulatory performance can improve certainty and trust. Industry players often face challenges when requirements are unclear, overlapping or inconsistently enforced. A coordinated regulatory system can reduce ambiguity by providing clearer procedures and more predictable enforcement. This is especially useful for small and medium agrofood enterprises that may lack resources to manage complex compliance demands. Studies on indirect tax compliance among Malaysian SMEs, for example, show that a responsive regulatory approach, which adjusts enforcement to the behaviour and capacity of regulated firms, can support more effective compliance than a uniform enforcement style (Sanusi et al., 2021). At the same time, better compliance intelligence can ensure that enforcement focuses on high-risk actors rather than treating all firms in the same way. This supports a more proportionate regulatory environment. Over time, such an environment can encourage responsible business conduct and strengthen the competitiveness of the agrofood sector.

For researchers, the paper opens several avenues for future empirical study. First, researchers can examine the relationship between regulatory coordination and supply chain resilience using survey or case study methods. Second, future studies can assess whether compliance intelligence improves enforcement effectiveness and reduces response time. Third, researchers can develop performance measurement models that capture both



regulatory outputs and food security outcomes. Fourth, comparative studies can examine how different countries structure agrofood enforcement and what lessons can be transferred to developing economies. Finally, future work can explore how digital platforms influence trust, transparency and compliance behaviour in agrofood regulation. These research directions would strengthen the academic foundation of regulatory performance in supply chain governance.

CONCLUSION

This paper has argued that regulatory performance is a critical but often underexplored driver of agrofood supply chain resilience. The agrofood sector cannot be made resilient through production, logistics or market mechanisms alone. It also requires regulatory institutions that are coordinated, intelligence-driven and accountable for outcomes. The Malaysia scenario shows how fragmented mandates, separate information systems, uneven enforcement powers and limited end-to-end visibility can weaken the governance of agrofood supply chains. These challenges are not unique to Malaysia, as many developing economies face similar issues in aligning food security, regulatory enforcement and supply chain management. Therefore, the framework proposed in this paper has broader relevance. It provides a way to understand regulatory performance as part of the infrastructure of resilience. The conceptual contribution of this paper lies in integrating four dimensions into one framework: regulatory coordination, compliance intelligence, performance measurement and adaptive supply chain resilience. The framework extends supply chain governance literature by positioning public regulatory systems as active contributors to resilience. It also contributes to performance management literature by showing that regulatory indicators should move beyond activity counts toward outcome-oriented measures. Practically, the paper offers guidance for policymakers and regulators seeking to strengthen agrofood governance. It suggests that reforms should prioritise integrated data, risk-based enforcement, clear accountability and system-level performance indicators. In doing so, agrofood regulation can move beyond fragmented enforcement toward a more responsive and resilient governance model. Future empirical research can test the proposed framework across different agrofood subsectors and institutional settings.

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