# Agricultural Land-Use Dynamics in the Vietnamese Mekong Delta: Policy Shifts, Practical Trade-Offs, and Livelihood Resilience

**Nguyen Van Chuong Tien[1*], Le Hoang Nam[2], Le Ky Dien[2], Le Thi Kim Mai[3], Nguyen Vo Chau Ngan[3*]**

**[1]Environment Protection Agency, Department of Agriculture and Environment of Can Tho City - Vietnam**

**[2]Economic Office of An Huu Commune, Dong Thap Province - Vietnam**

**[3]College of Environment and Natural Science, Can Tho University, Can Tho City - Vietnam**

***Corresponding Author**

**DOI: https://dx.doi.org/10.51584/IJRIAS.2026.110200123**

**Received: 01 March 2026; Accepted: 06 March 2026; Published: 18 March 2026**

## ABSTRACT

The Vietnamese Mekong Delta is confronting double exposure to global climate change and anthropogenic stressors, notably accelerating land subsidence, sediment depletion, and protracted salinity intrusion. In this context, agricultural land-use transition has emerged as an inevitable livelihood adaptation strategy. Utilizing a systematic review approach integrated with the Sustainable Livelihoods Framework, this paper critically analyzes land-use dynamics in the Vietnamese Mekong Delta to elucidate the acute trade-offs between national food security, short-term economic gains, and long-term ecological integrity. The findings reveal that the legacy rice-first mandate and hard-engineering interventions have eroded natural capital and undermined the livelihood resilience of smallholder farmers, thereby exacerbating their vulnerability. The study also evaluates the paradigm shift in state policy from "controlling nature" toward "flexible adaptation". By leveraging the transformative provisions of the 2024 Land Law regarding multi-purpose land use and land consolidation, the paper proposes the adoption of Adaptive Agro-Ecological Zoning to resolve fresh-saline water conflicts. These policy instruments provide a timely a legal foundation for reconciling economic development with environmental sustainability, while emphasizing the necessity of building robust social safety nets to protect marginalized communities during this sustainable transition.

**Keywords:** climate change, land policy, land-use change, livelihood resilience, trade-offs, Vietnamese Mekong Delta.

## INTRODUCTION

The Vietnamese Mekong Delta (VMD) stands as one of the world's most expansive and agriculturally productive deltas, playing a vital role in both national and regional food security. This region accounts for over 50% of Vietnam's total food staples and contributes more than 90% of its rice exports, while providing a primary source of livelihood for nearly 18 million inhabitants (Chapman & Darby, 2016). However, in recent decades, the delta has been confronted with a double exposure to global environmental shifts and internal socio-economic developmental pressures (O'Brien & Leichenko, 2000).

Physically, this deltaic landscape is acutely vulnerable to climate change, manifested through accelerated sea level rise, erratic precipitation patterns, and an intensification of extreme weather events, most notably protracted droughts, and salinity intrusion (Eslami *et al.*, 2021). Crucially, anthropogenic drivers are catalyzing ecosystem degradation at a pace that far outstrips natural climatic shifts. The proliferation of upstream hydropower cascades and rampant sand mining have decimated sediment delivery by approximately 70–75%, triggering severe bank erosion (Anthony *et al.*, 2015; Kondolf *et al.*, 2018). Concurrently, the over-extraction of groundwater for domestic and intensive agricultural use has led to alarming rates of land subsidence, reaching 5–6 cm per year in certain hotspots, thereby threatening the very geomorphological integrity of the delta (Erban *et al.*, 2014; Minderhoud *et al.*, 2017).

In response to these draconian environmental shifts, agricultural land-use transition has emerged as an

indispensable survival and developmental strategy. Historically, state policies in Vietnam have prioritized national food security through a "rice-first" mandate, operationalized via extensive closed-dike systems for triple-crop rice intensification (Kontgis *et al.*, 2015; Tran *et al.*, 2021). Nevertheless, under the duress of extreme salinity and freshwater scarcity, a profound transformation is unfolding at the grassroots level; farmers are increasingly – either spontaneously or through incentives – shifting from rice monoculture to brackish-water aquaculture (shrimp) or high-value perennial fruit crops.

While this transition is inevitable, current scholarship highlights a significant policy-practice decoupling: a rupture between macro-level planning and the lived realities of local livelihoods (Korbee *et al.*, 2019). Existing research has predominantly focused on hydrological modeling or isolated crop yields, yet lacks a critical, holistic synthesis of the multi-dimensional trade-offs inherent in land-use conversion. Transitions from rice to shrimp, or the maintenance of intensive diked-rice systems, may yield short-term economic gains or satisfy national production quotas, but often incur long-term costs: soil nutrient depletion, water pollution, pathogen outbreaks, and, most critically, heightened vulnerability for marginalized and landless smallholders (Chapman & Darby, 2016; Nguyen *et al.*, 2020).

Consequently, this paper aims to systematically synthesize and analyze existing literature, legal frameworks, and empirical studies to: (i) evaluate the evolutionary trajectory of land and agricultural management policies in the VMD; (ii) analyze land-use transition practices through the lens of socio-economic and environmental trade-offs; and (iii) assess the impacts of these policies and processes on the livelihood resilience of rural communities. Building on these findings, the paper proposes strategic policy directions to foster adaptive land management and sustainable development within the VMD.

# METHODOLOGY

To ensure transparency, the systematic review followed a four-stage screening protocol. Initially, 447 records were identified from Scopus, Web of Science, and Google Scholar using keywords such as 'land-use dynamics', 'Mekong Delta', and 'livelihood resilience'. After removing 121 duplicates, 326 records were screened by title and abstract, excluding 244 irrelevant studies. Of the 82 full-text articles assessed, 46 were excluded for lacking empirical rigor, resulting in 36 peer-reviewed papers for final synthesis.

The temporal scope of this literature review is purposefully focused on the last decade (2014–2024) to capture the most significant paradigm shift in Vietnam's delta management policy. This period encompasses two landmark policy milestones: Resolution 120/NQ-CP (2017) on sustainable and climate-resilient development of the VMD, which officially shifted the state strategy from "combatting nature" to "actively living with nature", and the Mekong Delta Regional Master Plan (2022), the first integrated regional planning in Vietnam's history. Focusing on this timeframe allows for a rigorous analysis of how these strategic shifts have influenced land-use transitions and livelihood resilience in response to the accelerating climate-driven stressors of the past decade.

**Data collection and selection criteria**

The review process was conducted through a multi-dimensional approach, encompassing both statutory regulatory frameworks and empirical scientific research.

Policy and legal frameworks: The study reviews core orientational legal documents of the Vietnamese State, focusing on the transformative provisions of the 2024 Land Law regarding expanded land-use limits and flexible agricultural land conversion. Furthermore, Resolution 120/NQ-CP on the sustainable development of the VMD in adaptation to climate change, along with national and regional land-use plans, were critically examined.

Academic literature: Comprehensive searches were performed across reputable scholarly databases, including Scopus and Web of Science, utilizing primary keywords: land-use change, livelihood resilience, agricultural policy, trade-offs, and Mekong Delta. Selection criteria prioritized peer-reviewed articles published within the last decade that provide empirical evidence on the socio-economic and environmental impacts of land-use conversion.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume XI Issue II February2026

# THEORETICAL FRAMEWORK

The study adopts the Sustainable Livelihoods Framework (SLF), originally proposed by the UK Department for International Development (DFID, 1999) and subsequently adapted to the environmental change context of the VMD as its analytical foundation (Tran *et al.*, 2021). According to this framework, rural livelihoods are constituted by five core assets: Human Capital (skills, labor), Natural Capital (land, water, ecosystems), Financial Capital (income, credit), Physical Capital (dikes, irrigation infrastructure), and Social Capital (cooperative networks, community institutions) (Pal *et al.*, 2024).

Agricultural land-use transition (e.g., from rice to shrimp or rice intensification) is conceptualized as a household livelihood strategy in response to stressors within the vulnerability context (sea-level rise, subsidence, drought, salinity) under the governance of transforming structures and processes (Land Law, regional planning) (Nguyen *et al.*, 2020; Ostrom, 2011). Furthermore, this paper integrates the concept of "Resilience Capacity", encompassing absorptive, adaptive, and transformative capacities (Poelma *et al.*, 2021). This integration allows for a deeper analysis of whether land conversion genuinely fosters a more resilient socio-ecological system or merely serves as a transient solution that exacerbates the long-term vulnerability of marginalized groups.

While this study does not employ new primary field surveys, it functions as a high-level meta-synthesis of existing empirical data. By integrating findings from over 35 localized studies – including household surveys from Chapman & Darby (2016), land-use mapping by Tran et al. (2021), and livelihood assessments by Nguyen et al. (2020) – this research provides a multi-scalar perspective that a single primary study cannot achieve. This approach allows for the identification of regional patterns and long-term policy impacts across the entire VMD, bridging the gap between site-specific empirical evidence and macro-level policy frameworks.

**Theoretical And Policy Framework for Agricultural Land Management**

**Policy discourse shifts: From rice-first mandates to flexible adaptation**

For over three decades following the Doi Moi (Renovation) reforms in 1986, agricultural and land policies in the VMD were heavily dominated by a "rice-first" agenda to ensure national food security and stimulate exports (Biggs, 2010; Nguyen *et al.*, 2020). This process was institutionalized through rigid legal instruments, such as Resolution 63/NQ-CP, which strictly mandated the preservation of 3.8 million hectares of rice cultivation nationwide (Government of Vietnam, 2009). To operationalize this objective, the state intervened aggressively in the hydrological system by constructing extensive closed-dike networks in the upper floodplains (An Giang, Dong Thap) for triple-crop intensification, and saline intrusion control structures in coastal areas (e.g., the Ba Lai dam in Ben Tre) to freshen the estuarine environment (Le *et al.*, 2018; Tran *et al.*, 2021).

However, viewed through the critical lens of sustainable livelihoods, this freshening and intensification strategy has incurred severe socio-ecological trade-offs. The enclosure of floodplains for a third rice crop has completely obstructed the influx of nutrient-rich alluvial sediment from the Mekong River, leading to soil nutrient depletion and forcing farmers into a cycle of chemical fertilizer dependency (Hung *et al.*, 2012; Tran *et al.*, 2021). System dynamics modeling reveals a paradox: while the shift from double to triple-crop rice yields macro-economic benefits for state exports and financial gains for large-scale (wealthier) landowners, it traps smallholder farmers in a debt cycle due to escalating input costs and long-term yield stagnation (Chapman & Darby, 2016). In coastal zones, the "freshwater-priority" policy deprived farmers of opportunities to transition to brackish-water aquaculture – a livelihood offering significantly higher returns than rice – thereby igniting intense interest conflicts between local producers and regulatory agencies (Hoanh *et al.*, 2003; Pham *et al.*, 2020).

Under the mounting pressure of climate change (notably the historic 2016 and 2020 saline droughts) and internal market demands, the state's management philosophy was compelled to evolve. A primary milestone was the Mekong Delta Plan 2013, which recommended a transition from rice intensification toward agricultural industrialization and advocated for the treatment of brackish and saline water as productive resources (Royal Haskoning DHV, 2013). This shift culminated in the landmark Resolution 120/NQ-CP (2017) on the sustainable development of the VMD. Resolution 120 marks a historical turning point: transitioning from a "Nature-control and aggressive intervention" mindset toward "Nature-based Adaptation" (NbA) – actively coexisting with floods, droughts, and varying salinity levels (Government of Vietnam, 2017). This policy restructured the

regional agricultural hierarchy into a new order of priority: Aquaculture–Fruit-trees–Rice, effectively decoupling smallholders from the pressures of rice monoculture (Nguyen *et al.*, 2020).

This vision has been further operationalized through Decision 287/QD-TTg, approving the Mekong Delta Regional Plan for 2021–2030 with a vision to 2050 (Prime Minister of Vietnam, 2022), and its subsequent implementation via Decision 816/QD-TTg (Prime Minister of Vietnam, 2023). These frameworks aim to develop adaptive agro-ecological zones, enhance agricultural value chains, and gradually phase out low efficiency rice areas in favor of more resilient land-use systems.

**Breakthroughs of the 2024 Land Law for livelihood management and transition**

While strategic orientations such as Resolution 120 opened new avenues for transition, their implementation frequently encountered regulatory bottlenecks in land legislation. The 2013 Land Law, characterized by stringent quotas on land transfers and restrictive conditions for converting agricultural land use, severely constrained the adaptive capacity of local populations (Nguyen *et al.*, 2020). To rectify these systemic inadequacies, the 2024 Land Law which effective since January 01, 2025 (National Assembly of Vietnam, 2024) introduces core legal revolutions, providing robust instruments for agricultural reform:

First, enhanced flexibility in rice land use (Article 182): The 2024 Land Law stipulates that rice land users are permitted to transition crop and livestock structures without compromising the essential conditions for reverting to rice cultivation. Crucially, the law now allows farmers to utilize a portion of their rice land for constructing facilities directly serving agricultural production (Article 182, Clause 5). This resolves a persistent practical grievance in the VMD, enabling the lawful construction of greenhouses, pumping stations, storage units, or preliminary processing facilities – essential for high-tech agriculture – without the risk of being penalized for "unauthorized land-use conversion" as under previous regimes.

Second, institutionalizing multi-purpose land-use regimes (Article 218): This denotes one of the most progressive mechanisms of the new Law, serving as a key player for sustainable livelihoods. The concept of "Combined Multi-purpose Land Use" permits agricultural land to be utilized in conjunction with commercial services, livestock, and eco-tourism (Article 218, Clause 1). For a climate-impacted region like the VMD, this establishes a secure legal corridor for circular livelihood strategies and income diversification. For instance, the "Rice–Lotus–Fish" model integrated with flood-season eco-tourism in Dong Thap, or "Rice– Shrimp" systems coupled with experiential services in Bac Lieu, are now legally protected, enhancing farmers' financial capital while remaining consistent with spatial planning (Trang & Loc, 2022).

Third, facilitating large-scale land accumulation and concentration (Articles 192, 193): Land fragmentation has long been a barrier to technological adoption and a source of vulnerability to market fluctuations for VMD farmers. The 2024 Land Law clearly delineates between "Land concentration" (through plot swapping, leasing, or production cooperation) and "Land accumulation" (through transfer of rights or capital contribution). A landmark provision expands the individual quota for receiving agricultural land-use rights to 15 times the initial allocation limit (Article 177). This relaxation incentivizes agribusinesses and resourceful farmers to consolidate land, fostering large-scale value chains (e.g., fruit, aquaculture) and bolstering resilience against climate risks.

Fourth, safeguarding the livelihoods of marginalized groups: The 2024 Land Law demonstrates heightened attention to vulnerable populations through provisions on compensation, vocational training, and occupational transition support (Article 109). Specifically, when the state reclaims agricultural land, farmers are eligible for financial support up to five times the prevailing land price, alongside targeted vocational training and job placement policies. For ethnic minority communities, the Law includes specific articles (Article 16) to ensure land funds and prohibit the transfer of supported land, thereby preserving the essential natural capital required for their traditional livelihoods.

In conclusion, the synergy between Resolution 120/NQ-CP and the 2024 Land Law has significantly narrowed the policy-practice gap. Previously, farmers were often forced into "unauthorized transitions" (e.g., spontaneously introducing saline water into rice paddies for shrimp farming) as a desperate measure for climate survival. Today, the revised legal framework empowers them with the tools to transition in a manner that is legally recognized, secure, and multi-valued.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume XI Issue II February2026

**Table 1.** Evolution of land management policies and livelihood transitions in the VMD

| Period | Strategic orientation | Key policies and legal frameworks | Practical impacts and livelihood trade-offs |
|---|---|---|---|
| Pre-2000: Institutional reform and spatial expansion | De-collectivization and decentralization: Transitioning from collective farming to a household-based economy to resolve national food crises. | - Directive 100 (1981) and Resolution 10 (1988): Allocated land use rights to individual farmers.<br>- 1993 Land Law: Granted long-term (20-year) land use rights and the five rights of land transactions.<br>- Decision 99/TTg (1996): Expanded irrigation networks; reclaimed acid sulfate soils in the Plain of Reeds and Long Xuyen Quadrangle. | - Impacts: Provided immense incentives for farmers, transforming Vietnam into a leading rice exporter. Cropping intensity surged from single to double/triple cropping.<br>- Consequences: Mass mangrove deforestation in coastal areas due to spontaneous shrimp farming driven by early market signals. |
| 2000–2015: Nature control and rice-first mandates | Macro-food security: Deployment of hard engineering solutions for total flood control in the upper delta and salinity prevention in coastal zones to maximize rice output. | - Resolution 63/2009/NQ-CP: Ensured national food security by strictly preserving the rice land fund.<br>- 2003 and 2013 Land Laws: Imposed agricultural land quotas and restricted the conversion of rice land.<br>- Decree 42/2012/ND-CP and Decree 35/2015/ND-CP: Strictly regulated the management and utilization of rice paddies. | - Impacts: Rice production skyrocketed due to closed-dike systems and salinity control structures (e.g., the Ba Lai dam).<br>- Trade-offs: Disruption of fresh saline ecological connectivity. Triple-cropping depleted soil fertility due to sediment starvation, forcing a dependency on agrochemicals. Constrained farmers' adaptive capacity, igniting socio-economic conflicts between shrimp and rice producers. |
| 2016–present: Nature-based adaptation and flexible governance | Paradigm shift: Moving from "nature control" to "proactive coexistence" with floods and salinity; transitioning from an "agricultural production" mindset to an "agricultural economy" logic. | - Resolution 120/NQ-CP (2017): Sustainable development of the VMD through nature-based principles; restructured priorities to: Aquaculture– Fruit Trees–Rice.<br>- Decision 287/QD-TTg (2022): Integrated regional Master Plan 2021–2030; emphasizing AAEZ. | - Impacts: Legalized rotational models (e.g., rice-shrimp). Enhanced resilience through livelihood diversification and high-value value chains.<br>- Trade-offs: High initial transition costs. Risk of maladaptation if localized subsidence and sediment loss are not holistically addressed. |

*(*Source: Compiled by the authors based on the Vietnam Land Laws (1993, 2003, 2013), Resolution 120/NQCP (2017), and synthesized from Biggs, 2010; Chapman & Darby, 2016; and Nguyen et al., 2020)

**Land-Use Transition Practices and Socio-Ecological Trade-Offs**

Land-use transition in the VMD is not a spatially homogenous process; rather, it is characterized by profound geographic differentiation, driven by specific hydrological conditions and state-led infrastructural interventions. This process transcends simple shifts in crop or livestock composition, representing a complex series of multidimensional trade-offs between economic growth, ecosystem preservation, and the livelihood security of diverse social groups.

**Distinctive spatial transition trends**

**Coastal zones: The shift from rice monoculture to aquaculture**

In coastal provinces such as Ca Mau, Bac Lieu, Soc Trang, Tra Vinh, and Kien Giang, salinity intrusion has emerged as the definitive ecological determinant. The most intensive transition occurred between the late 1990s and early 2000s, when declining profitability from rice monoculture, coupled with market liberalization policies, incentivized farmers to pivot toward shrimp farming (Le *et al.*, 2018). The superior yields and profit margins of shrimp relative to rice triggered an explosion in aquacultural area. For instance, empirical evidence from Kien Giang indicates that the average annual income for households adopting the integrated rice–shrimp model reached approximately 106 million VND (equivalent to 4,553 USD), significantly outperforming specialized rice farming (69 million VND) or specialized shrimp farming (66.5 million VND) (Poelma *et al.*, 2021).

The rotational rice–shrimp model – cultivating rice during the freshwater-dominant rainy season and rearing shrimp during the saline-dominant dry season – is widely recognized as a sophisticated and sustainable adaptive strategy, allowing farmers to capitalize on dual environmental conditions (Thu & Ha, 2025). However, in hypersaline regions (e.g., coastal Ca Mau), rice paddies have been entirely replaced by intensive shrimp systems or integrated shrimp–mangrove models, as salinity levels have surpassed the threshold for rice tolerance (typically > 4 g/L) (Yuen *et al.*, 2021).

**Inland and flood-prone regions: From dike-enclosed intensification to livelihood diversification**

In the upper floodplains of An Giang and Dong Thap, closed-dike systems were rapidly constructed following the historic flood of 2000 to safeguard agricultural production, enabling farmers to increase cropping intensity from two to three rice cycles per annum (Chapman & Darby, 2016). Between 2000 and 2015, the area dedicated to the triple-rice crop in An Giang surged from 2,591 ha to 150,000 ha (Quang *et al.*, 2020).

However, as the profit margins for the third rice crop have dwindled due to escalating input costs and soil degradation, contemporary transitions are diverging into two paths. First is the shift toward high-value perennial fruit crops. By 2023, the total fruit orchard area in the delta exceeded 400,000 ha, with durian, pomelo, and mango models generating revenues of 500–600 million VND/ha/year – ten times higher than rice cultivation (Thu & Ha, 2025). Second is the adoption of flood-based livelihoods, such as floating rice combined with indigenous fish rearing and lotus cultivation. These models not only double household incomes compared to rice monoculture but also restore the natural ecological functions of the floodplain (Thu & Ha, 2025).

**Peri-urban zones: Urbanization and livelihood precarity**

Urban expansion and industrialization are rapidly encroaching upon agricultural land in peri-urban areas like Can Tho, Long An, and Tien Giang. In the Cai Rang district of Can Tho City, cultivated land area plummeted by over 50% between 2000 and 2008, while the non-agricultural labor force surged by 350% (Garschagen *et al.*, 2011). Land acquisition is frequently accompanied by inadequate compensation, which is insufficient for farmers to re-establish livelihoods or acquire agricultural land elsewhere (Garschagen *et al.*, 2011). This pushes a significant portion of the rural population, particularly the youth, into occupational displacement, forcing labor migration to major industrial hubs such as Ho Chi Minh City or Binh Dương Province. Between 2009 and 2019, the VMD recorded over 1.1 million out-migrants, reflecting the precarity and vulnerability of rural communities under the pressure of land-use conversion (Thu & Ha, 2025).

**Trade-offs and conflicts in land management**

**The conflict between short-term economic gains and ecological sustainability**

The intensification of triple-crop rice within closed-dike systems serves as a typical example of the trade-off between immediate economic growth and long-term environmental degradation. High-dike infrastructures completely obstruct the influx of nutrient-rich alluvial floodwaters. System dynamics modeling by Chapman & Darby (2016) identifies a hazardous systemic time lag: during the initial 2–4 years of transitioning to a third crop, farmers enjoy increased incomes bolstered by residual sediment nutrients. However, after a period of 6–9 years, this natural nutrient buffer is depleted, compelling farmers to escalate the application of inorganic

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume XI Issue II February2026

fertilizers and pesticides to sustain yields. This dependency increases input costs by 58% to 91%, trapping capital-constrained smallholder farmers in a debt spiral, while macro-level benefits (rice exports) and the interests of affluent farmers – who possess larger landholdings and higher adaptive capacity – remain secure (Chapman & Darby, 2016; Nguyen *et al.*, 2020). Evidently, this model trades the integrity of the soil ecosystem and the resilience of marginalized groups for national food export achievements.

Similarly, the transition to intensive shrimp farming offers superior economic returns but consumes a vast amount of natural capital. The expansion of shrimp ponds is intrinsically linked to mangrove deforestation and the contamination of surface water due to chemical residues and untreated feed waste (Can *et al.*, 2007). Furthermore, the over-extraction of groundwater for aquacultural and domestic use is driving land subsidence at rates of 1.1–2.5 cm/year, exacerbating future risks of flooding and salinity intrusion (Yuen *et al.*, 2021).

The causal relationship between hard-engineering interventions and livelihood decline is vividly illustrated through the causal loop mechanism. Drawing on the system dynamics approach of Chapman & Darby (2016), triple-crop intensification within closed dikes triggers a vicious socio-ecological cycle. The loop originates with the construction of high dikes for total flood prevention to protect the third rice crop. However, the immediate trade-off is the absolute blockage of nutrient-rich sediment from natural flood pulses. As this natural nutrient buffer is exhausted, soil fertility plummets. To compensate for this deficit and meet target yields, farmers are forced into a continuous escalation of inorganic fertilizer and pesticide inputs.

This reliance on agrochemical inputs causes production costs to skyrocket – on average requiring an 87% increase in synthetic fertilizers compared to conventional double-crop models. These high input costs erode farmers' profit margins. For small-scale households in particular, low profitability precludes the accumulation of risk contingency funds. Consequently, when faced with fertilizer price shocks or extreme weather events, these farmers easily lapse into financial precarity, leading to forced borrowing and the debt trap. Notably, the system exhibits a significant delay: farmers typically enjoy profits for the first 6–9 years due to legacy sediment, but subsequently, the degradational loop manifests clearly, fundamentally undermining the economic and technological resilience capacity of small-scale producers.

**Conflict between national food security and household livelihoods**

A profound institutional trade-off exists in the contradiction between state-led food security mandates and the profit-maximization imperatives of smallholder farmers. National policies, such as Decree 42/2012/ND-CP and subsequently Decree 35/2015/ND-CP, established stringent quotas to preserve the “Rice land fund,” strictly prohibiting farmers from unauthorized land-use conversion (Nguyen *et al.*, 2020).

While the state prioritizes land preservation for strategic food security, rice cultivation yields marginal returns for farmers – often insufficient to sustain livelihoods amidst escalating climate shocks. Consequently, legal applications to transition from rice to high-value aquaculture or fruit orchards frequently encounter complex administrative bottlenecks, driving farmers toward “spontaneous” or illicit conversions (Nguyen *et al.*, 2020). Local authorities occasionally adopt a “policy of silence” toward these transitions while continuing to report the areas as rice land to comply with centralized targets (Nguyen *et al.*, 2020). This spatial planning rigidity, which favors rice monoculture, has inadvertently constrained farmers' adaptive capacity, depriving them of opportunities to transition toward livelihood models with higher resilience to salinity and drought (Nguyen *et al.*, 2020).

The tension between national rice mandates and individual livelihood aspirations is fundamentally driven by the stark disparity in economic returns. To provide a clearer comparative perspective, Table 3 summarizes the qualitative cost-benefit analysis, highlighting how different land-use models prioritize either national stability or household-level economic gains.

**Table 2.** Qualitative cost-benefit analysis and socio-ecological trade-offs of major land-use models

| Land-use model | Short-term economic gains | Long-term ecological costs | Production costs and risks |
|---|---|---|---|
| Intensive rice (Triple-crop) | High and stable: Provides immediate food security and cash flow. | Severe: Soil exhaustion, 87% increase in fertilizer use (Tran *et al.*, 2018), and loss of natural flood sediment. | Rising: High dependency on agrochemicals; vulnerability to low market prices. |

| Land-use model | Short-term economic gains | Long-term ecological costs | Production costs and risks |
|---|---|---|---|
| Rice–Shrimp (Rotational) | Very high: Profit margins can be 2–3 times higher than monorice. | Low/Regenerative: Natural waste from shrimp fertilizes the rice; maintains soil health. | High risk: High initial investment; 40% risk of crop loss due to disease or salinity shocks. |
| Fruit trees (Salt-tolerant) | Highest: Significant export value (e.g., durian, green-skin pomelo). | Moderate: Requires heavy freshwater irrigation and "dyke protection," leading to local subsidence. | Capital intensive: 3-5 years of zero income during growth; high cost for salinity monitoring systems. |

However, as indicated in Table 3, the pursuit of higher economic returns through aquaculture or fruit trees often requires specific hydrological conditions. The ecological disruption caused by large-scale infrastructure, such as the Ba Lai sluice system, represents a physical manifestation of these trade-offs, where the effort to protect freshwater for rice has inadvertently crippled the brackish-water livelihoods analyzed in the following section 4.2.3.

**Ecological disruption and fresh–saline water conflicts: The case of the Ba Lai sluice system**

Infrastructural interventions aimed at "freshening" coastal zones have triggered severe ecological disruptions and ignited intra-community interest conflicts. The Ba Lai dam project, completed in 2002, serves as a quintessential case study. The project's objective was to close the river mouth to prevent salinity intrusion and store freshwater for upstream rice and fruit cultivation (Tran *et al.*, 2022).

However, this "freshwater-priority" policy disregarded the lived realities of a significant segment of farmers who sought to maintain high-profit brackish-water shrimp farming. Consequently, many farmers within the freshened zones resisted by illegally drilling thousands of groundwater wells to extract saline water (or pumping brackish water from the river) into their shrimp ponds (Tran *et al.*, 2022; Nguyen *et al.*, 2020). This action led to localized salinization, devastating the adjacent fruit orchards and rice paddies of households complying with the freshening mandate (Tran *et al.*, 2022).

Furthermore, the abrupt and unscheduled discharge of freshwater from the Ba Lai dam into downstream saline zones caused severe environmental shock, resulting in mass die-offs of clams, blood cockles, and shrimp (Tran *et al.*, 2022). The Ba Lai case exemplifies how hard-engineering solutions aimed at altering land-use landscapes – when lacking community consultation and disregarding livelihood diversity – result in state water appropriation from farmers. Such top-down interventions push communities into confrontation and fundamentally undermine the holistic resilience capacity of the entire region (Tran *et al.*, 2022).

**Implications for livelihood resilience**

Viewed through the lens of the SLF, the trade-offs inherent in land-use transition are actively reshaping farmers' asset portfolios, leading to a profound divergence in livelihood resilience.

First, there is a documented escalation in socio-economic inequality. Resource-rich farmers (possessing significant financial and physical capital) have emerged as the primary beneficiaries of the transition process. This group maintains the capacity to invest in intensive shrimp farming technologies, drip irrigation systems for high-value fruit orchards, or to absorb price shocks in agricultural inputs within triple-crop rice models (Chapman & Darby, 2016). Conversely, small-scale and landless farmers (characterized by chronic capital constraints) have become increasingly marginalized. The loss of wild aquatic resources due to closed-dike systems – representing a significant depletion of natural capital – has dismantled their traditional livelihood safety nets (Quang *et al.*, 2020).

Second, transformative capacity is being stifled by institutional rigidities. Although adaptive models – such as integrated rice–shrimp systems in coastal zones or rice–lotus–fish systems in flood-prone areas – demonstrate superior resilience compared to mono-culture, their adoption is hindered by fragmented planning, restricted credit access, and the imposition of static land-use quotas (Poelma *et al.*, 2021). For many impoverished households, when localized assets are exhausted, the ultimate adaptation strategy is not a shift in land-use practices, but rather land abandonment and distress labor migration to major urban centers (Thu & Ha, 2025).

In summary, the reality of land-use transition in the VMD reveals a landscape defined by competition and conflict. Land management policies predicated on hard-engineering environmental interventions (dikes and sluices) to facilitate agricultural intensification have yielded macro-economic gains in the short term but at the cost of significant ecological degradation and the disruption of livelihoods for vulnerable groups. Resolving these trade-offs necessitates a more flexible land-governance paradigm – one that transcends the "rice-first" bias to embrace multi-objective socio-ecological systems.

## Challenges To Management and Livelihood Resilience

### Emerging ecological risks: Land subsidence and sediment depletion

While land management policies and climate change scenarios frequently focus on sea-level rise, recent empirical studies indicate that localized anthropogenic stressors are threatening the delta's viability at a much higher velocity.

The most critical challenge currently is land subsidence driven by excessive groundwater extraction. The transition from rice monoculture to aquaculture (shrimp, pangasius) or high-value agricultural intensification demands vast quantities of freshwater, leading to a proliferation of unregulated wells. According to Minderhoud *et al.* (2017), subsidence rates in the VMD fluctuate between 1.1 and 2.5 cm/year; over 25 years of extraction (since 1991), the region has subsided by an average of 18 cm, with some hotspots exceeding 30 cm. In certain areas, the rate reaches an alarming 5–6 cm/year. This process not only lowers the elevation of a delta that sits only ~0.82 m above mean sea level but also exacerbates salinity intrusion and flooding, creating a vicious feedback loop: freshwater scarcity leads to groundwater pumping, pumping causes subsidence, and subsidence allows saltwater to penetrate further inland.

In addition to subsidence, sediment hunger – caused by rampant instream sand mining and upstream hydropower cascades – is permanently altering the delta's eco-morphology. Sediment delivery to the VMD has plummeted by 70–75% compared to pre-1990 levels. In 2018 alone, approximately 17.77 million $m^3$ of sand were extracted from the Mekong riverbed. The loss of alluvial influx not only triggers bank erosion (with over 562 erosion hotspots spanning 800 km recorded in 2022) but also reduces natural flood frequency, depriving agricultural lands of essential organic nutrients.

A significant lacuna in state management is that current climate adaptation strategies predominantly address symptoms (e.g., constructing saline dams and sluices) while ignoring these localized root causes. Land-use planning and developmental projects rarely incorporate measures to restrict groundwater use or manage sand mining, leaving multi-billion dollar agricultural investments at risk of being rendered obsolete as the land literally sinks below sea level.

### Institutional fragmentation and land-use planning gaps

Land-use transition in the VMD reveals significant gaps in cross-sectoral risk governance, characterized by a lack of synchronization both vertically (central to local) and horizontally (between ministries).

First is the fragmentation of state management. Historically, resource management in Vietnam was bifurcated between the Ministry of Agriculture and Rural Development (MARD) – responsible for agricultural development and irrigation infrastructure, and the Ministry of Natural Resources and Environment (MONRE) – overseeing climate change, land funds, and water resources. Inconsistencies frequently arose at the intersection of these mandates. For instance, while MONRE establishes national land-use plans with rigid provincial quotas, MARD dictates spatial realities through irrigation infrastructure planning. This top-down planning rarely reflects grassroots dynamics, leaving local authorities without the institutional agency to meet farmers' needs for

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume XI Issue II February2026

livelihood transition. Although the unification into the Ministry of Agriculture and Environment (effective July 1, 2025) aims to dismantle these silos, a new challenge emerges of establishing effective internal coordination to prevent "sectoral silos" from persisting within the unified ministry.

Second is the contradiction between macro-orientational policies. Regional development strategies exhibit a tension between "specialization" and "diversification." Berchoux *et al.* (2023) identified a direct opposition between Decision 124/QD-TTg (promoting triple-crop rice and intensive aquaculture) and Decision 639/QDTTg (encouraging crop diversification and sustainable rice–shrimp systems). If the specialization pathway is pursued, it could reduce rural employment opportunities by up to 46% due to its capital-intensive and mechanized nature, while simultaneously increasing vulnerability to climatic extremes.

Third is the rigidity of agricultural land-use planning. Rice land protection quotas (intended for national food security) act as a major legal barrier for farmers. Instead of allowing flexible transitions based on market signals and environmental conditions, rigid regulations force farmers through convoluted administrative procedures. Consequently, illicit or spontaneous conversions occur frequently, while local authorities may turn a blind eye to avoid violating centralized targets. This inadequacy demonstrates that static land-use planning has become obsolete in the face of unpredictable salinity intrusion dynamics.

**Erosion of livelihood capitals and divergence in resilience capacity**

Through the SLF's len, land-use transitions and environmental stressors are fundamentally reshaping the five livelihood capitals (Natural – Financial – Physical – Human – Social), triggering a profound divergence in the resilience capacity of rural communities.

Triple-crop rice intensification within closed-dike systems has led to rapid soil degradation due to the loss of alluvial influx, forcing farmers into an over-reliance on chemical fertilizers and pesticides. In An Giang, the continuous escalation of input costs, coupled with volatile rice prices, has severely eroded the profit margins of smallholders (falling below 30 million VND/year/household), plunging them into financial precarity and debt spirals. Concurrently, the transition to intensive shrimp farming in coastal zones requires substantial financial capital that impoverished households cannot access, effectively disenfranchising them from adaptive opportunities.

The process of land accumulation primarily benefits affluent farmers – those with large-scale holdings and ready access to mechanization and credit – while marginalizing smallholders and the landless. Furthermore, the construction of closed dikes to protect intensive rice areas has decimated wild aquatic resources during the flood season. As these resources traditionally serve as the primary social safety net for the poor and landless, their disappearance represents a total dispossession of traditional income sources and a depletion of natural capital.

When localized capitals are eroded and in-situ resilience fails, distress migration emerges as an inevitable survival strategy. Between 2009 and 2019, the VMD experienced a record migratory outflow of over 1.1 million people, predominantly young laborers relocating to industrial hubs in Ho Chi Minh City and Binh Duong Province. In 2019 alone, out-migration reached 147,000 individuals. The contraction of agricultural employment opportunities, driven by climate change and intensification policies, is causing a severe "brain drain" of human capital. This labor deficit leaves behind an aging population and children, undermining the capacity for technological adoption and threatening the long-term sustainability of rural economic models.

As illustrated in Figure 1, the disparity in livelihood resilience is not merely conceptual but reflected in stark quantitative gaps. Based on a cross-synthesis of recent empirical studies, well-off farmers typically maintain a financial buffer 2.5 times greater than vulnerable groups. Conversely, the latter faces a significant debt-toincome ratio, often exceeding 50% due to crop failures and high input costs. By quantifying these capital assets, this study moves beyond the generalized framework of Tran *et al*. (2021) to provide a more nuanced operationalization of the SLF in the VMD context.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume XI Issue II February2026

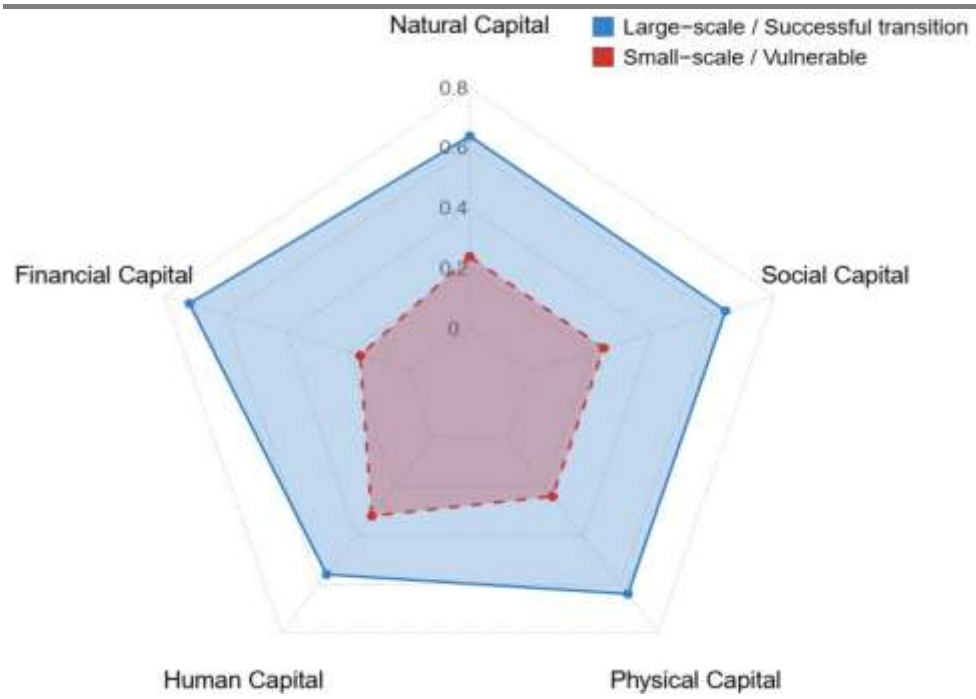


Figure 1. Comparative assessment of livelihood capitals between well-off and vulnerable groups in the VMD

[Source: Data synthesized and quantified by authors from Tran et al. (2021), Nguyen et al. (2020), and Chapman & Darby (2016)]

In summary, the management and transition of land use in the VMD are currently confronted by intertwined challenges, arising from emerging ecological risks and institutional rigidities. Policy frameworks skewed toward technical interventions and short-term economic orientations risk pushing the region's socio-ecological system into a state of maladaptation. To foster genuine livelihood resilience, management strategies must fundamentally address institutional barriers, mitigate inequalities in resource access, and adopt a holistic vision to counteract land subsidence and sediment depletion.

To counteract the erosion of livelihood capitals, it is imperative to move beyond abstract social safety nets toward legally-enforceable mechanisms (Nguyen *et al*., 2020). The 2024 Land Law provides a timely framework to address these vulnerabilities. Specifically, the implementation of Article 109 (Support for vocational training and job transition) offers a vital lifeline for smallholders whose natural capital has been depleted by salinity, enabling them to shift into non-farm or high-tech agricultural sectors (Chapman & Darby, 2016). Furthermore, while Article 177 facilitates land consolidation to enhance economic efficiency, it must be integrated with cooperative-based models to ensure that vulnerable farmers are not dispossessed of their land (Tran *et al*., 2022).

These safety net articles, if strictly operationalized, can bridge the resilience gap between well-off and marginalized groups, ensuring that land-use transitions do not lead to further socio-economic exclusion (Tran *et al*., 2018).

**Stakeholder dynamics and implementation feasibility**

The transition toward an Adaptive Agro-Ecological Zoning (AAEZ) framework is not merely a technical realignment but a complex socio-political process involving diverse stakeholders with diverging interests. Understanding the power dynamics and potential resistance from these actors is crucial for assessing the feasibility of proposed land-use changes. As the VMD moves away from a rigid rice-first mandate, conflicts arise between national objectives (e.g., food security, export targets) and local aspirations (e.g., household profitability, immediate livelihood needs). To provide a comprehensive overview of these interactions, Table 4 presents a stakeholder analysis matrix, identifying the key actors, their influence, and the likely challenges they pose to the implementation of integrated land-use management.

As illustrated in Table 4, the implementation of the AAEZ framework is a multi-actor process with diverging interests. While the central government (MARD) provides the legal and strategic vision, the actual success of

land-use transitions depends on the alignment between provincial economic targets and farmer-level profitability. The 'Moderate' consensus of farmers highlights a critical gap: without addressing the financial risks and technical barriers identified in the AAEZ models, top-down planning may face significant bottom-up resistance or uncoordinated spontaneous transitions.

**Table 3.** Stakeholder analysis matrix for the implementation of the AAEZ framework

| Stakeholder group | Key interests and objectives | Power/Influence | Level of consensus with AAEZ | Potential resistance and challenges |
|---|---|---|---|---|
| MARD and Central Government | National food security; Export growth; Climate resilience. | High: Policymaking, budget allocation, and infrastructure planning. | High: Aligned with Resolution 120 and the 2022 Master Plan. | Resistance to reducing rice land quotas due to long-term food security concerns. |
| Provincial authorities | Local GDP growth; Social stability; Meeting central mandates. | Medium-High: Direct implementation and local land-use planning. | Moderate: Some provinces prefer high-profit fruit trees over recommended AAEZ models. | Conflict between regional integrated planning and province specific economic targets. |
| Local farmers | Immediate income; Risk minimization; Livelihood security. | Low-Medium: Decisions on land-use at the household level. | Varies: High for profitable models (shrimp); Low if transitions require high capital. | Resistance if the transition lacks initial financial support or technical training. |
| Private agribusinesses | Profitability; Stable raw material zones; Value chain control. | Medium: Control over market access, inputs, and technology. | Moderate-High: Favor high-value crops and aquaculture. | Limited interest in “pro-poor” models or areas with poor logistics /infrastructure. |

**Quantitative trade-offs: A multi-criteria assessment**

The Multi-Criteria Decision Analysis (MCDA) results (Table 5) quantitatively illustrate the acute trade-offs inherent in the delta’s land-use planning. While intensive rice scores highest for national food security, it ranks lowest in ecological sustainability due to soil exhaustion and chemical dependency. Conversely, the Rice–Shrimp model emerges as the most balanced option (total 12), aligning with the “Nature-based” philosophy by maintaining a synergy between economic return and ecological health. This scoring system justifies why the AAEZ framework does not seek a single optimal model for the whole delta, but rather a diversified portfolio where models are selected based on their regional suitability and the prioritization of specific criteria.

**Table 4.** The MCDA of dominant land-use models

| Land-use model | Economic income (Household) | National food security | Ecological sustainability | Total score | Best-fit zone |
|---|---|---|---|---|---|
| Intensive rice (3 crops) | 2 | 5 | 1 | 8 | Upper delta (Freshwater) |
| Rice–Shrimp (Rotational) | 4 | 3 | 5 | 12 | Coastal/Transition (Brackish) |
| Fruit trees (Orchards) | 5 | 1 | 3 | 9 | Alluvial levees/Upland |
| Intensive shrimp | 5 | 1 | 1 | 7 | Coastal (Saline) |

**Solutions And Strategic Orientations for Sustainable Development**

To resolve the acute trade-offs between short-term economic growth and long-term sustainability, while simultaneously enhancing community resilience, land-use management, and transition in the VMD necessitate a systemic paradigm shift. Based on the challenges analyzed, this paper proposes the following four strategic solution clusters:

**Transitioning toward Adaptive Agro-Ecological Zoning (AAEZ)**

The failure of traditional, static land-use planning necessitates the adoption of an AAEZ model in the VMD. Unlike static planning predicated on administrative boundaries or long-term average conditions, AAEZ functions as a dynamic planning mechanism. It integrates hydrological-salinity scenarios (e.g., salinity probabilities $P_{50}/P_{85}$), duration of salinity exposure, and the regulatory capacity of irrigation infrastructure to determine spatially appropriate land-use patterns (Chung & Tinh, 2026).

Specifically, land-use planning should be demarcated into three flexible functional zones (Chung & Tinh, 2026):

Freshwater core zone: Areas where salinity remains below 1‰ for more than 300 days per year (e.g., Dong Thap, Long An, Vinh Long). In these regions, policy should prioritize the preservation of rice land while upgrading technology for water conservation and diversifying with short-day upland crops during the dry season.

Brackish-saline transitional zone: Areas where salinity fluctuates between 1–4‰ for 60–150 days per year (e.g., Tra Vinh, Soc Trang). This zone requires regulatory liberalization to fully transition toward rotational rice–shrimp models, coupled with early-warning salinity systems to enable proactive seasonal scheduling for farmers.

High-risk saline zone: Coastal regions (e.g., Ca Mau, Ben Tre) where salinity exceeds 4‰ for more than 90 days. Attempts to freshen these areas via dike enclosures are both unrealistic and cost prohibitive. Instead, planning must formally recognize and support the development of ecological brackish-water aquaculture systems, such as integrated shrimp–mangrove models.

The integration of AAEZ into the five-year provincial planning cycles would mitigate the risks of maladaptation and terminate the long-standing fresh–saline water conflicts.

The salinity thresholds defined in the AAEZ (Table 2) are aligned with the Climate Change and Sea Level Rise Scenarios for Vietnam (MONRE, 2016/2020). Under the RCP 4.5 scenario, by 2050, the 4‰ salinity boundary is projected to encroach 15–20 km further inland compared to the 2005 baseline, potentially affecting over 40% of the rice-growing area in coastal provinces. In the more extreme RCP 8.5 pathway, combined with land subsidence, salinity intrusion could persist for 5–7 months annually in the Brackish Transitional Zone. Consequently, the transition from triple-cropped rice to rotational rice-shrimp or salt-tolerant aquaculture is not merely an economic choice but a necessary adaptation to the projected hydro-geological shifts in the VMD.

**Table 5.** Proposed AAEZ and empirical feasibility assessment

| **Functional Zones** | **Salinity thresholds and scenarios** | **Proposed landuse models** | **Economic performance (Estimated)** | **Feasibility and farmer adoption (Key constraints)** |
|---|---|---|---|---|
| Freshwater core zone (e.g., Dong Thap, An Giang) | < 1‰ (Stable under RCP 4.5) | Rice intensification (2–3 crops) or Rice–Lotus–Fish | Rice: 30–40 million VND/ha/year. Rice–Lotus–Fish: 60-80 million VND/ha/year. | High feasibility for rice, but 3rd crop faces sediment depletion. Adoption of diversification is limited by unstable market prices. |

| Functional Zones | Salinity thresholds and scenarios | Proposed landuse models | Economic performance (Estimated) | Feasibility and farmer adoption (Key constraints) |
|---|---|---|---|---|
| Brackish transitional zone (e.g., Tra Vinh, Soc Trang) | 1–4‰ (Projected to expand 15% by 2050) | Rotational Rice-Shrimp or Salt tolerant Fruit trees | Rice–Shrimp: ~106 million VND/ha/year. Fruit trees: 500–600 million VND/ha/ year. | Moderate feasibility. Rice-shrimp requires 30–50% higher initial capital than mono-rice. Fruit trees face a 3–5 year "income gap" before harvest. |
| Saline core zone (e.g., Coastal Ca Mau, Bac Lieu) | > 4‰ (Persistent > 6 months under RCP 8.5) | Intensive shrimp or Integrated Shrimp–Mangrove | Specialized shrimp: ~66.5 million VND/ha/year (High risk/return ratio). | Challenging adoption for poor households due to high infrastructure costs and technical risks (pathogen outbreaks). |

(Source: Compiled, revised, and developed by the author based on the AAEZ framework of Chung & Tinh (2026) and the provisions of the 2024 Land Law)

**Institutionalizing flexibility: Leveraging the breakthroughs of the 2024 Land Law**

To ensure that bottom-up livelihood transitions are not stifled by administrative hurdles, the effective implementation of the 2024 Land Law is paramount. This legislation provides a robust legal foundation to bridge the current policy-practice decoupling.

Promoting multi-purpose land use: Article 218 of the 2024 Land Law permits agricultural and water-surface land to be utilized in conjunction with commerce, services, and eco-tourism without altering the primary land-use classification (National Assembly, 2024). This serves as a critical legal lever for developing circular economy models. For instance, rice and shrimp farmers can now lawfully construct temporary structures for agro-tourism (e.g., community-based tourism in My Hoa Hung, An Giang), thereby diversifying income streams without infringing upon land-use mandates (Thu & Ha, 2025).

Facilitating land concentration and accumulation: The transition to high-tech agriculture – such as superintensive shrimp farming or large-scale fruit orchards –requires significant capital and land consolidation. Articles 192 and 193 of the 2024 Land Law expand the quotas and mechanisms for land concentration (via plot swapping, leasing, or capital contribution through land-use rights) (National Assembly, 2024). This policy facilitates the formation of "Large-scale field" models, enabling cooperatives and enterprises to invest in synchronized infrastructure and enhance resource efficiency. However, stringent monitoring mechanisms are essential to ensure that land accumulation does not result in the proletarianization or displacement of smallholder farmers.

However, the legal flexibility provided by the 2024 Land Law must be synchronized with targeted infrastructure investment to be effective. As land consolidation (Articles 192-193) scales up production, the demand for specialized water management and logistics infrastructure increases. Table 6 provides an estimation of the required investments across different AAEZ zones, benchmarked against major regional projects such as VnSAT and the World Bank's MD-ICRSL.

**Table 6.** Estimated infrastructure investment requirements for AAEZ implementation

| AAEZ zone | Key infrastructure requirements | Estimated unit cost/Project scale | Reference project/Source |
|---|---|---|---|
| Freshwater zone | Upgrade of high-dike systems; Pumping stations for flood control. | $150–200 million per sub-region. | VnSAT Project (Sustainable Rice Development). |

| AAEZ zone | Key infrastructure requirements | Estimated unit cost/Project scale | Reference project/Source |
|---|---|---|---|
| Brackish/ Transition zone | Smart sluice gates for saline-fresh regulation; Canal dredging for shrimp-rice. | $380 million (Integrated climate resilience). | WB - MD-ICRSL Project (Mekong Delta Integrated Climate Resilience). |
| Saline zone | Mangrove restoration; Sea dyke reinforcement; Saltwater treatment plants. | $5,000–$7,000 per hectare for restoration. | WB - GCF Projects (Green Climate Fund). |
| General region | Digital monitoring systems (IOT) for salinity & water quality. | $20–30 million for delta-wide network. | Mekong Regional Master Plan 2022. |

**Shifting toward "Nature-based" and "Ecological restoration" models**

In alignment with Resolution 120/NQ-CP, land management strategies must shift from "total environmental control" via hard infrastructure to a "living with nature" paradigm.

Upper floodplains: Closed-dike intensification for triple-crop rice should be restricted. Instead, a "3-3-2" (8 crops in 3 years) or "3-2" (5 crops in 2 years) cropping cycle should be adopted to allow dikes to open for seasonal flooding (Tran *et al.*, 2021). Controlled flooding facilitates soil desalinization, alluvial deposition, and disrupts pest life cycles, significantly reducing chemical fertilizer and pesticide expenditures for subsequent seasons (Chapman & Darby, 2016). To offset income loss during fallow flood periods, flood-based livelihoods – such as floating rice integrated with indigenous fish and lotus – should be scaled, as these models have demonstrated the potential to double household incomes compared to rice monoculture (Thu & Ha, 2025).

Coastal Zones: The integrated rice-shrimp model has proven to be highly resilient. International certification standards (e.g., ASC, VietGAP) should be integrated to create circular value chains: shrimp waste fertilizes the rice, while rice stubble provides natural feed for the shrimp. This synergy allows farmers to achieve profit margins of up to 100 million VND/ha/year while preserving the coastal ecosystem (Thu & Ha, 2025).

**Strengthening livelihood resilience and social safety nets**

Land-use transition cannot be sustainable if it marginalizes vulnerable groups. Analysis using the SLF indicates that farmers currently face acute deficits in financial and human capital.

Consolidating financial capital, the State must expand access to concessionary credit for impoverished farmers to fund transition costs, such as purchasing seedlings or converting paddies to orchards (Poelma *et al.*, 2021; Tran *et al.*, 2018). Furthermore, index-based agricultural insurance tied to climate risks (salinity, drought, subsidence) should be developed to share the burden of crop failure with producers.

Enhancing human and social capital, the transition toward digital and smart agriculture necessitates a highly skilled workforce. Extension programs should evolve beyond basic agronomy to include risk management and market-access training. Strengthening Agricultural Cooperatives is a core solution to bolster farmers' collective bargaining power, enabling direct linkages with export enterprises and supermarkets, thereby resolving the persistent paradox of bumper crops, falling prices (Pal *et al.*, 2024; Tran *et al.*, 2021).

**Limitations of the study**

While this study provides a comprehensive synthesis of land-use transitions and livelihood resilience in the VMD, certain limitations must be acknowledged. First, the analysis relies primarily on secondary data, including peer-reviewed literature, government reports, and policy documents. To mitigate potential biases and ensure reliability, a triangulation method was employed, cross-referencing qualitative findings from academic research with quantitative data from official statistical yearbooks and international development reports (e.g., World Bank, Mekong River Commission). Second, there is an inherent temporal lag between the enactment of transformative

policies, such as Resolution 120 (2017), and their observable impacts on the ground, which may not be fully captured in the current literature. Finally, given the high degree of agro-ecological and socioeconomic diversity across the VMD, the findings represent generalized patterns; localized variations in farmer responses to salinity intrusion may require further primary field-based empirical validation.

## CONCLUSION

The agricultural land-use transition in the VMD has transcended the status of a spontaneous economic trend to become an indispensable survival adaptation strategy in response to the double exposure of global climate change and regional anthropogenic interventions. Through a critical analytical lens, this review demonstrates that the livelihood transformation process in the VMD is inherently defined by acute socio-ecological trade-offs: specifically, the tension between immediate economic gains and long-term ecosystem degradation, as well as the conflict between macro-level food security mandates and the micro-level livelihood security of individual households.

The persistence of rice-first orientations enforced through hard-engineering interventions – such as closed-dike systems and salinity control sluices – has encountered clear ecological limits. These interventions have exacerbated land subsidence, disrupted alluvial sediment fluxes, and pushed smallholder farmers into states of heightened vulnerability, proletarianization, or forced migration. Consequently, the land management paradigm must decisively shift from a nature-control philosophy toward a NbA approach, as envisioned in Resolution 120/NQ-CP.

The emerging legal framework, particularly the transformative provisions of the 2024 Land Law regarding land concentration, accumulation, and multi-purpose land-use regimes, provides the necessary regulatory corridor to dismantle long-standing institutional barriers. However, for these policies to be effectively operationalized, spatial planning must adopt the AAEZ model based on empirical hydrological risks while fostering bottom-up community participation. Developmental strategies must move beyond a singular focus on economic growth to prioritize the construction of social safety nets, the provision of concessionary credit, and vocational training to ensure that marginalized farmers are not disenfranchised during the transition process.

Finally, this paper proposes that future research should employ integrated socio-ecological system models to quantitatively assess the long-term impacts of land-use conversion on subsidence risks and resource depletion. Land governance in the VMD can only achieve sustainable development when it establishes a delicate equilibrium between economic efficiency, environmental integrity, and social equity.

## REFERENCES

1. Anthony, E. J., Brunier, G., Besset, M., Goichot, M., Dussouillez, P., & Nguyen, V. L. (2015). Linking rapid erosion of the Mekong River delta to human activities. Scientific Reports 5, 14745. DOI: 10.1038/srep14745.
2. Berchoux, T., Hutton, C. W., Hensengerth, O., Voepel, H. E., Tri, V. P. D., Vu, P. T., Hung, N. N., Parsons, D., Darby, S. E. (2023). Effect of planning policies on land use dynamics and livelihood opportunities under global environmental change: Evidence from the Mekong Delta. Land Use Policy 131, 106752. DOI: 10.1016/j.landusepol.2023.106752.
3. Biggs, D. (2010). Quagmire: Nation-building and nature in the Mekong Delta. University of Washington Press. e-ISBN: 978-0-295-80154-4.
4. Can, N. D., Duong, L. T., Sanh, N. V., Miller, F. (2007). Livelihoods and resource use strategies in the Mekong Delta. In: Challenges to Sustainable Development in the Mekong Delta: Regional and National Policy Issues and Research Needs. The Sustainable Mekong Research Network (Sumernet), Bangkok, Thailand, 69–98.
5. Chapman, A. D., & Darby, S. E. (2016). Evaluating sustainable adaptation strategies for vulnerable megadeltas using system dynamics modelling: Rice agriculture in the Mekong Delta's An Giang Province. Science of The Total Environment 559, 326-338. DOI: 10.1016/j.scitotenv.2016.02.162.
6. Chung, N. T., & Tinh, N. D. (2024). Adaptive agro-ecological zoning for climate-resilient land use in the Mekong delta. Water Practice & Technology 21(2), 672-688. DOI: 10.2166/wpt.2026.214.

7. DFID (1999). Sustainable livelihoods guidance sheets. Department for International Development, London, UK.
8. Erban, L. E., Gorelick, S. M., & Zebker, H. A. (2014). Groundwater extraction, land subsidence, and sealevel rise in the Mekong Delta, Vietnam. Environmental Research Letters 9, 084010. DOI: 10.1088/17489326/9/8/084010.
9. Eslami, S., Hoekstra, P., Minderhoud, P. S. J., Trung, N. N., Hoch, J. M., Sutanudjaja, E. H., Dung, D. D., Tho, T. Q., Voepel, H. E., Woillez, M. N, & van der Vegt, M. (2021). Projections of salt intrusion in a mega-delta under climatic and anthropogenic stressors. Communications Earth & Environment 2, 142. DOI: 10.1038/s43247-021-00208-5.
10. Garschagen, M., Renaud, F. G., & Birkmann, J. (2011). Dynamic resilience of peri-urban agriculturalists in the mekong delta under pressures of socio-economic transformation and climate change. In: Environmental Change and Agricultural Sustainability in the Mekong Delta. Springer, Dordrecht. DOI: 10.1007/978-94-007-0934-8_9.
11. Government of Vietnam (2009). Resolution No. 63/NQ-CP dated 23/12/2009 on National food security. Ha Noi (in Vietnamese).
12. Government of Vietnam (2017). Resolution No. 120/NQ-CP dated 17/11/2017 on Sustainable and climateresilient development of the Vietnamese Mekong Delta. Ha Noi (in Vietnamese).
13. Hoanh, C. T., Tuong, T. P., Gallop, K. M., Gowing, J. W., Kam, S. P., Khiem, N. T., & Phong, N. D. (2003). Livelihood impacts of water policy changes: Evidence from a coastal area of the Mekong river delta. Water Policy 5(5-6), 475–488. DOI: 10.2166/wp.2003.0030.
14. Hung, N. N., Delgado, J. M., Tri, V. K., Hung, L. M., Merz, B., Bárdossy, A., & Apel, H. (2012). Floodplain hydrology of the Mekong Delta, Vietnam. Hydrological Processes 26(5), 674–686. DOI: 10.1002/hyp.8183.
15. Kondolf, G. M., Schmitt, R. J. P., Carling, P., Darby, S., Arias, M., Bizzi, S., Castelletti, A., Cochrane, T. A., Gibson, S., Kummu, M., Oeurng, C., Rubin, Z., & Wild, T. (2018). Changing sediment budget of the Mekong: Cumulative threats and management strategies for a large river basin. Science of the Total Environment 625, 114–134. DOI: 10.1016/j.scitotenv.2017.11.361.
16. Kontgis, C., Schneider, A., & Ozdogan, M. (2015). Mapping rice paddy extent and intensification in the Vietnamese Mekong River Delta with dense time stacks of Landsat data. Remote Sensing of Environment 169, 255-269. DOI: 10.1016/j.rse.2015.08.004.
17. Korbee, D., Quan, N. H., Hermans, L., & Long, H. P.. (2019). Navigating the bureaucracy: an analysis of implementation feasibility for the Mekong Delta Plan, Vietnam. Journal of Environmental Planning and Management 62, 1545-1561. DOI: 10.1080/09640568.2019.1623014.
18. Le, T. N., Bregt, A. K., van Halsema, G. E., Hellegers, P. J. G. J., Nguyen, L. D. (2018). Interplay between land-use dynamics and changes in hydrological regime in the Vietnamese Mekong Delta. Land Use Policy 73, 269–280. DOI: 10.1016/j.landusepol.2018.01.030.
19. Minderhoud, P. S. J., Erkens, G., Pham, V. H., Bui, V. T., Erban, L., Kooi, H., & Stouthamer, E. (2017). Impacts of 25 years of groundwater extraction on subsidence in the Mekong delta, Vietnam. Environmental Research Letters 12, 064006. DOI: 10.1088/1748-9326/aa7146.
20. National Assembly of Vietnam (2024). Law No. 31/2024/QH15 - Land Law dated on 18/01/2024 (in Vietnamese).
21. Nguyen, Q. H., Tran, D. D., Dang, K. K., Korbee, D., Pham, L. D. M. H., Vu, L. T., Luu, T. T., Ho, L. H., Nguyen, P. T., Ngo, T. T. T., Nguyen, D. T. K., Wyatt, A., Tran, T. A., & Sea, W. B. (2020). Land-use dynamics in the Mekong delta: From national policy to livelihood sustainability. Sustainable Development 28(3), 448-467. DOI: 10.1002/sd.2036.
22. O'Brien, K. L., & Leichenko, R. M. (2000). Double exposure: Assessing the impacts of climate change within the context of economic globalization. Global Environmental Change 10(3), 221-232. DOI: 10.1016/S0959-3780(00)00021-2
23. Ostrom, E. (2011). Background on the institutional analysis and development framework. Policy Studies Journal 39(1), 7-27.
24. Pal, I., Baskota, A., Dhungana, G., Banerjee, S., Udmale, P., Gadhawe, M. A., Doydee, P., Nguyen, T. T. N., & Sophat, S. (2024). Sustaining livelihoods and building resilience: Policy implications for the Lower Mekong Basin. APN Science Bulletin 14(1), 173-189. DOI: 10.30852/sb.2024.2723.
25. Pham, T. T. H., Diez, J. R., & Garschagen, M. (2020). A typology of household livelihood changes in rural coastal areas of the Vietnamese Mekong Delta - Capturing the heterogeneity and complexity of

the socialecological context. Singapore Journal of Tropical Geography 42(2), 241-263. DOI: 0.1111/sjtg.12335.

26. Poelma, T., Bayrak, M. M., Duong, V. N., & Tran, A. T. (2021). Climate change and livelihood resilience capacities in the Mekong Delta: a case study on the transition to rice–shrimp farming in Vietnam's Kien Giang Province. Climatic Change 164, 9. DOI: 10.1007/s10584-021-02973-w.
27. Prime Minister of Vietnam (2022). Decision No. 287/QD-TTg dated 28/02/2022 on Approval of the Mekong Delta Regional Master Plan for the period 2021–2030, with a vision to 2050. Hà Nội (in Vietnamese).
28. Prime Minister of Vietnam (2023). Decision No. 816/QĐ-TTg dated 07/7/2023 on Promulgating the Plan for Implementation of the Mekong Delta Regional Master Plan for the period 2021–2030, with a vision to 2050. Hà Nội (in Vietnamese).
29. Royal Haskoning DHV (2013). Mekong Delta Plan: Long-term vision and strategy for a safe, prosperous and sustainable delta. Hanoi, Vietnam. With consortium partner of: Wageningen University and Research Centre, Deltares, Rebel, and WATER.NL. https://www.mekongdeltaplan.com/storage/files/files/mekongdelta-plan.pdf?1.
30. Thu, H. N., & Ha, L. T. M. (2025). Livelihood transitions under climate change in the Mekong Delta of Vietnam. IOP Conference Series: Earth and Environmental Science 1539, 012001. DOI: 10.1088/17551315/1539/1/012001.
31. Tran, D. D., Ho, H. L., Hong, L. P., Pham, T. D., & Nguyen, A. H. (2021). Sustainability of rice-based livelihoods in the upper floodplains of Vietnamese Mekong Delta: Prospects and challenges. Agricultural Water Management 243, 106495. DOI: 10.1016/j.agwat.2020.106495.
32. Tran, D. D., Quang, C. N. X., Tien, P. D., Tran, P. G., Kim Long, P., Van Hoa, H., Ngoc Hoang Giang, N., & Thi Thu Ha, L. (2020). Livelihood vulnerability and adaptation capacity of rice farmers under climate change and environmental pressure on the Vietnam Mekong Delta Floodplains. Water 12(11), 3282. DOI: 10.3390/w12113282.
33. Tran, D. D., van Halsema, G., Hellegers, P. J. G. J., Ludwig, F., & Seijger, C. (2018). Stakeholders' assessment of dike-protected and flood-based alternatives from a sustainable livelihood perspective in An Giang Province, Mekong Delta, Vietnam. Agricultural Water Management 206, 187-199. DOI: 10.1016/j.agwat.2018.04.039.
34. Tran, T. A., Tran, H. V., Pittock, J., & Cook, B. (2022). Political ecology of freshening the Mekong's coastal delta: Narratives of place-based land-use dynamics. Journal of Land Use Science 17(1), 471–486. DOI: 10.1080/1747423X.2022.2126907.
35. Trang, N. T. T., & Loc, H. H. (2022). Eco-agritourism as an Ecosystem-based adaptation (EBA) against climate change impacts for the Vietnamese Mekong Delta: A viewpoint. IOP Conference Series: Earth and Environmental Science 1028, 012003. DOI: 10.1088/1755-1315/1028/1/012003.
36. Yuen, K. W., Tang, T. H., Vu, D. Q., Switzer, A. D., Teng, P., & Lee, J. S. H. (2021). Interacting effects of land-use change and natural hazards on rice agriculture in the Mekong and Red River deltas in Vietnam. Natural Hazards and Earth System Sciences 21(5), 1473-1493. DOI: 10.5194/nhess-21-1473-2021.