

## Linking Agricultural Policy Phases with Farm Level Transformation Pathways: A Case Study of an Giang Province, Vietnam

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### Abstract

Agricultural transformation in the Mekong Delta has evolved through successive policy phases, yet household-level outcomes remain uneven. This study examines how long-term agricultural policy shifts are translated into distinct transformation pathways at the farm level, using An Giang Province as a case study. A mixed-methods approach integrates qualitative data from Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) with a survey of 272 farm households. Five transformation pathways are analyzed: land-use system change, adoption of ecological practices and Nature-based Solutions (NBS), production and livelihood diversification, smart agriculture and digital technology adoption, and value-chain linkage transformation. Results indicate that transformation unfolds through multiple coexisting pathways rather than a linear trajectory. Digital agriculture and ecological/NBS practices are the most prevalent, whereas land-use conversion and formal value-chain participation remain limited. Chi-square tests show significant associations between livelihood structure, income level, and pathway choice, highlighting the mediating role of household resources. Higher-income and diversified households are more likely to adopt capital-intensive and market-oriented strategies, while rice-dependent and lower-income households implement incremental adjustments. The study conceptualizes agricultural transformation as a differentiated, resource-conditioned process and underscores the need for inclusive and context-sensitive policies to promote sustainable development in delta regions.

**Keywords:** agricultural transformation, digital agriculture, ecological practices, livelihood diversification, mekong delta, Vietnam

## 1. Introduction

Agricultural transformation is increasingly understood as a long-term, stage-based process shaped by policy regimes, rather than a linear shift from traditional to modern agriculture. It encompasses structural changes in production systems, land use, markets, institutions, and rural livelihoods, driven by evolving policy priorities, socio-economic dynamics, and environmental constraints (Timmer, 1988; Pingali, 2012; Reardon et al., 2019). As a result, agricultural transformation often unfolds unevenly across regions and social groups, reflecting differences in historical trajectories, livelihood strategies, and household capacities.

In the Mekong Delta, agricultural transformation has been strongly influenced by successive policy phases since the launch of the Doi Moi reforms in the late 1980s. The initial policy phase focused on restoring production after collectivization and ensuring food security, leading to rapid expansion and intensification of rice-based systems. Subsequent phases emphasized market-oriented restructuring, production diversification, and value-chain development, accompanied by large-scale investments in irrigation infrastructure and flood control. More recently, agricultural policy has shifted toward climate-adaptive and environmentally sustainable development, as reflected in Resolution 120, which promotes nature-based solutions, ecological agriculture, and adaptive land-use systems (Pingali & Xuan, 1992; Government of Vietnam, 2017).

However, while these policy shifts reflect an increasingly comprehensive national vision for agricultural development in the Mekong Delta, recent studies suggest that policy ambition often outpaces effective implementation at the local level. Minkman et al. (2022) approach agricultural transformation in the Delta through a transition governance lens, highlighting significant gaps between national policy vision and local implementation due to fragmented coordination, institutional constraints, and uneven provincial capacities. Similarly, research on land-use dynamics in the Delta shows that policy-driven changes in farming systems and land allocation do not automatically translate into improved and sustainable livelihoods, particularly when market conditions and household-level constraints are insufficiently considered (Nguyen et al., 2016).

At the household level, agricultural transformation is mediated by livelihood structures and income differentiation, which shape farmers' capacity and willingness to engage in different transformation options. Livelihood diversification, non-farm income, labor migration, and access to capital have been widely identified as key determinants of household responses to policy signals and environmental risks (Ellis, 2000; Barrett et al., 2001; Scoones, 2015). Empirical evidence from the Mekong Delta indicates that households adopt markedly different strategies ranging from incremental technical adjustments to structural shifts in land use and market integration even within the same policy context (Binh et al., 2005). This suggests that agricultural transformation is not income-neutral; existing livelihood inequalities can translate into uneven transformation outcomes.

Despite the growing body of research on agricultural transformation in the Mekong Delta, much of the literature remains analytically fragmented. Policy-oriented studies tend to focus on macro-level visions, governance mechanisms, and institutional reforms, while micro-level studies concentrate on the adoption of specific technologies or practices, such as organic agriculture, digital farming, or livelihood diversification. Consequently, the linkage between long-term agricultural policy phases and differentiated household-level transformation pathways remains insufficiently explored, particularly in empirical studies that integrate both levels of analysis.

This study seeks to address this gap by linking agricultural policy phases to household-level transformation pathways in An Giang Province, a representative agricultural province in the Mekong Delta. By combining historical analysis of agricultural policy phases (1986–2025) with household survey data, the study conceptualizes agricultural transformation as a multi-level process in which policy phases define a space of opportunity for change, while household livelihood structures and income levels shape the selection of specific transformation pathways. Specifically, the study analyzes the association between household livelihood and income characteristics and participation in five main transformation pathways: (i) land-use system transformation; (ii) adoption of ecological practices and nature-based solutions; (iii) production and livelihood diversification; (iv) smart agriculture and digital technology adoption; and (v) value-chain linkage participation.

Through this integrated macro–micro approach, the paper makes three main contributions. First, it situates household-level transformation practices within the long-term policy timeline, highlighting the cumulative and overlapping nature of agricultural policy phases in the Mekong Delta. Second, it provides empirical evidence on the heterogeneity of household-level transformation pathways, moving beyond aggregate measures of “transformation intensity.” Third, it demonstrates that livelihood strategies and income differentiation function as critical “filters” shaping household responses to policy-driven transformation programs. In doing so, the study offers policy-relevant insights into why agricultural transformation remains uneven and how future interventions can be better tailored to the diverse contexts of farm households.

## **2. Methods**

### *2.1. Study Area*

The study was conducted in An Giang Province, a key agricultural province in the Mekong Delta, where successive phases of agricultural transformation under state policy have been clearly manifested over the past three decades. An Giang is characterized by diverse agro-ecological conditions, including the flood-prone lowlands of the Long Xuyen Quadrangle, semi-mountainous upland areas, and zones along the Tien and Hau Rivers. These ecological variations support multiple production systems such as intensive rice cultivation, rice–fish systems, fruit orchards, aquaculture, and various non-farm activities.

At the same time, An Giang has been among the leading provinces in implementing agricultural restructuring policies, Resolution 120, and programs promoting ecological agriculture, digital transformation, and value-chain linkage development. As such, it represents a typical case study for examining the linkage between policy phases and household-level transformation pathways.

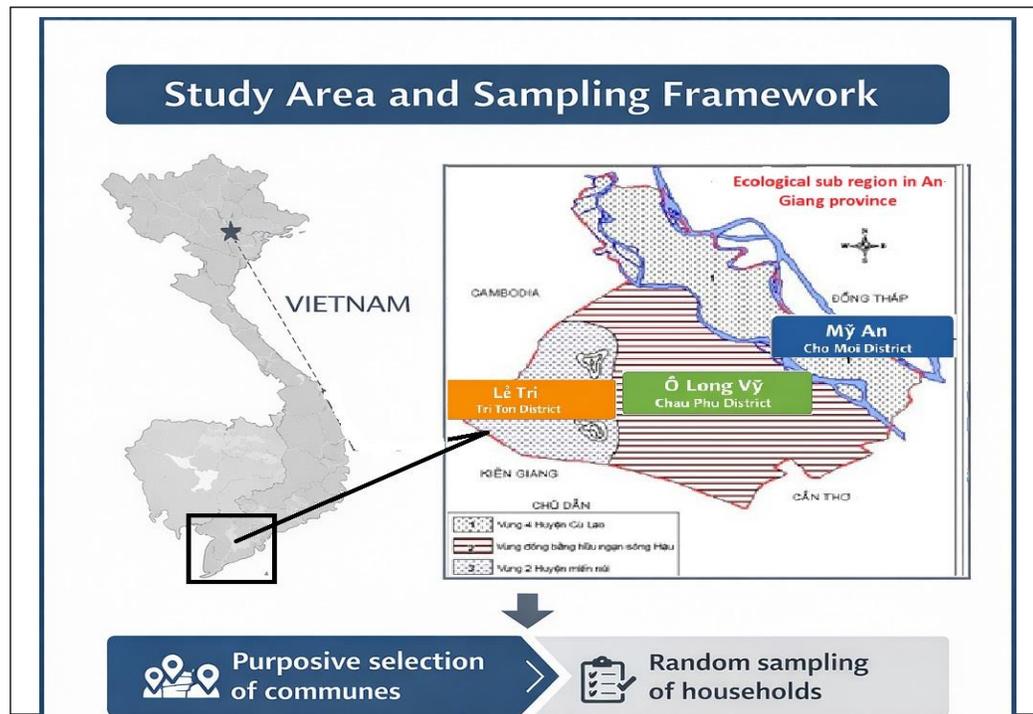


Figure1 : Study area

## 2.2. Data Collection and Sampling

Primary data were collected through a structured household survey, complemented by Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) to support qualitative interpretation. The household survey was conducted in [insert survey year], with a sample of 272 households distributed across districts representing different agro-ecological subregions and production systems in An Giang Province.

### Sample size determination

The sample size was calculated using the formula proposed by Yamane (1967):

$$n = \frac{N}{1 + N(e)^2}$$

$$n = \frac{5,960}{1 + 5,960(0.06)^2} = \frac{5,960}{1 + 21.456} \approx 265$$

Where:

- $N = 5,960$  represents the total number of agricultural households;
- $e = 0.06$  denotes the acceptable margin of error;
- $n = 265$  is the calculated sample size.

To enhance statistical reliability, the final sample was increased to 272 households. These were equally allocated among three communes: 90 households in Le Tri commune and 91 households each in My An and O Long Vi communes.

A stratified random sampling approach was employed. Communes/districts were first purposively selected based on diversity in farming systems and levels of participation in agricultural transformation programs. Within each location, households were randomly selected from official agricultural household lists provided by local authorities. The sample size ensured adequate statistical power for both descriptive and inferential analyses at the household level.

### *2.3. Measurement of Farm-Level Transformation Pathways*

Agricultural transformation at the household level was operationalized through five main transformation pathways (Y1–Y5), reflecting the core pillars of agricultural restructuring under Resolution 120:

- **Y1 – Land-use system transformation:** Conversion from rice monoculture to alternative systems such as rice–upland crops, fruit orchards, crop rotation/intercropping, or integrated models.
- **Y2 – Adoption of organic, ecological, and Nature-based Solutions (NBS):** Implementation of practices reducing chemical inputs, increasing organic fertilizers, applying biological agents, and adopting nature-based production approaches.
- **Y3 – Diversification of production systems and livelihoods:** Diversification of crops and livestock and/or engagement in non-farm income-generating activities.
- **Y4 – Adoption of smart agriculture and digital technologies:** Use of agricultural mobile applications, drones, smart irrigation systems, electronic farm records, and traceability tools.
- **Y5 – Value-chain linkage transformation:** Participation in cooperatives, contract farming arrangements, quality certification schemes, and structured value-chain models.

Each pathway was coded as a binary variable (1 = adopted; 0 = not adopted), enabling simultaneous analysis of multiple transformation choices at the household level.

### *2.4. Livelihood and Income Classification*

Household livelihood structure was identified based on primary income-generating activities, including rice cultivation, upland crops, fruit production, aquaculture, services and trade, non-farm employment, and labor migration. Because households may engage in multiple activities concurrently, livelihood variables were treated as multiple-response variables.

Household income was categorized into three groups (low, medium, and high) based on income percentiles within the survey sample. This classification captures economic differentiation among households and enables analysis of the relationship between income level and agricultural transformation pathway choices.

### *2.5. Analytical Methods*

Data analysis proceeded in three main steps. First, descriptive statistics were used to characterize household livelihood structures and the prevalence of agricultural transformation pathways. Second, Chi-square tests were applied to examine associations between: (i) livelihood structure and transformation pathways; and (ii) income groups and transformation pathways. The Chi-square method is appropriate for categorical and binary variables, allowing tests of independence between variables. Third, quantitative findings were interpreted in conjunction with qualitative evidence from FGDs and KIIs to clarify underlying mechanisms explaining why different household groups select distinct transformation pathways under the same policy context.

## **3. Results**

### *3.1. Policy phases and agricultural transformation narratives*

The process of agricultural transformation in the Mekong Delta since 1986 can be understood as a sequence of policy-driven phases reflecting shifts in national development priorities and regional governance approaches. Beginning with the *Đổi mới* reforms focused on food security and rice expansion, the region moved toward intensive, export-oriented production supported by large scale irrigation and triple rice-cropping systems. This was followed by agricultural restructuring aimed at diversification, with stronger emphasis on aquaculture and fruit production linked to market integration. Since the promulgation of Resolution 120/NQ-CP, the transformation narrative has shifted toward climate adaptation, the “living with nature” approach, reduced dependence on rice monoculture, and the promotion of ecological, high-value, and more recently digital and circular agricultural models. In An Giang Province, these orientations have materialized through land-use conversion, adjustments in dike and irrigation systems, expansion of pangasius farming and fruit orchards, development of value-chain linkages, and gradual adoption of digital technologies in agricultural production.

Table 3.1. Phases of Agricultural Transformation and Policy Implementation in Vietnamese Mekong Delta & An Giang Province (1986–2025)

Transformation phase	Period	Key policies/events	Changes in Mekong Delta	Manifestations in An Giang
<b>STAGNANCY</b> (post-collectivization recovery)	1986–1995	<i>Doi Moi</i> reforms; land-use rights allocation	Production recovery and expansion of rice cultivation	Allocation of rice land to households; reclamation of floodplain areas in Long Xuyen Quadrangle
	1995–2000	Food security and rice export policy	Rice intensification, large irrigation systems, 2–3 crops/year	Canal systems in Long Xuyen Quadrangle; increased cropping intensity
<b>PRE-TRANSITION</b> (marketization & diversification)	2000–2005	Agricultural restructuring and market orientation	Expansion of fruit crops, aquaculture, coastal shrimp farming	Development of pangasius and rice–fish systems
	2005–2010	Risk management and sustainability concerns	Dyke systems, flood control, mechanization	Closed-dyke expansion, brown planthopper outbreaks, hydrological changes
	2010–2017	Agricultural restructuring plan (Decision 899)	Specialized production zones and value-chain linkages	High-quality rice areas and new-type cooperatives
<b>TRANSITION</b> (climate adaptation & green transformation)	2017–2020	Resolution 120 – climate-resilient development	Ecological farming, nature-based solutions (NbS), climate adaptation	Rice–shrimp and rice–fish systems; floodplain ecological restoration
	2023–2025+	One-million-hectare low-emission rice program	Low-carbon agriculture and GHG MRV systems	Digital farm records, emission-reduction practices, circular farming models

Findings from Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs) (table 3.1) indicate that agricultural transformation in the Mekong Delta and An Giang Province has unfolded through successive yet overlapping policy phases, reflecting the long-term and cumulative nature of the transformation process (Pingali & Xuan, 1992; Biggs et al., 2009; Minkman et al., 2022). Qualitative narratives clarify how national policy orientations have been selectively interpreted and operationalized at the local level.

During the period 1986–2000, the Doi Moi reforms, land-use rights allocation, and irrigation investments stimulated double- and triple-cropping rice intensification, particularly in the flood-prone Long Xuyen Quadrangle (Le Coq et al., 2001; Biggs et al., 2009). The 2000–2017 phase expanded production options through agricultural restructuring and market orientation; however, the expansion of high dyke systems and intensified production also increased ecological risks (Kakonen, 2008; Sakamoto et al., 2009a).

Since 2017, Resolution 120 has promoted a “nature-based” development approach, emphasizing ecological agriculture and green transformation. Nevertheless, FGDs reveal uneven implementation across household groups, largely depending on livelihood structures and economic resources (Ellis, 2000; World Bank, 2016).

*3.2. Livelihood structure of rural households*

Rural livelihoods in An Giang Province exhibit a diversified structure shaped by ongoing agricultural transformation and adaptive responses to market pressures and climate uncertainty in the Mekong Delta. Although rice cultivation particularly two and three-crop systems continues to play an important role, a substantial share of households combine crop production with fruit and vegetable farming, machinery rental and small businesses, non-farm employment, and labor migration. This multiplicity of income sources reflects a gradual shift away from single crop dependence toward more flexible livelihood portfolios designed to enhance income stability and reduce vulnerability. Table 3.2 summarizes the livelihood structure of the 272 surveyed households, using multiple responses to capture the complexity of rural income strategies

Table 3.2. Livelihood structure of surveyed households (multiple responses, N = 272)

<b>Livelihood activities</b>	<b>Frequency (N)</b>	<b>% of responses</b>	<b>% of households</b>
Three-crop rice farming	81	19.3	32.3
Two-crop rice farming	44	10.5	17.5
Vegetable cultivation	28	6.7	11.2
Fruit cultivation	70	16.7	27.9
Machinery rental & small business	60	14.3	23.9
Non-farm employment	82	19.5	32.7
Labor migration	55	13.1	21.9
<b>Total responses</b>	<b>420</b>	<b>100.0</b>	<b>167.3</b>

The analytical results reveal a diversified livelihood structure among the 272 farm households surveyed in An Giang Province, characterized by the coexistence of agricultural and non-agricultural activities.

Although rice production remains central (32.3% of households cultivate triple rice crops; 17.5% cultivate double rice crops), a substantial proportion of households engage in non-rice activities, including fruit production (27.9%), non-farm employment (32.7%), mechanization services and small-scale trading (23.9%), and labor migration (21.9%).

This multi-livelihood pattern is consistent with previous studies indicating that farm households combine multiple income sources to mitigate production risks and adapt to market volatility and ecological pressures (Ellis, 2000; Barrett et al., 2001). The high share of non-farm income reflects broader processes of market integration and rural economic restructuring, and provides an important foundation for explaining heterogeneity in agricultural transformation pathway choices at the household level (World Bank, 2016; Reardon et al., 2019) (see Table 3.2).

*3.3. Prevalence of farm-level transformation pathways*

The extent to which farm households in An Giang Province participate in different agricultural transformation pathways reflects the multidimensional nature of the ongoing restructuring process in the Mekong Delta. The findings indicate that transformation does not follow a single trajectory; rather, households simultaneously adopt multiple strategies, including land-use system conversion, ecological and nature-based practices, diversification of production and livelihoods, application of digital technologies, and value-chain linkages. Notably, smart agriculture and digital technologies exhibit the highest adoption rate, followed by ecological/NBS practices, suggesting a shift toward knowledge-intensive and sustainability-oriented production models. The table is based on multiple-response data, highlighting the overlapping and complementary nature of transformation decisions at the household level.

Table 3.3. Adoption of agricultural transformation pathways at the household level

<b>Transformation pathways</b>	<b>Frequency (N)</b>	<b>% responses</b>	<b>of % households</b>
Y1 – Land-use system transformation	99	14.5	38.5
Y2 – Organic, ecological and NBS practices	154	22.5	59.9
Y3 – Diversification of production and livelihoods	118	17.2	45.9
Y4 – Smart agriculture and digital technologies	191	27.9	74.3
Y5 – Value-chain linkage transformation	123	18.0	47.9
<b>Total responses</b>	<b>685</b>	<b>100.0</b>	<b>266.5</b>

Agricultural transformation at the household level in An Giang Province unfolds through multiple parallel pathways with varying levels of prevalence. The adoption of smart agriculture and digital technologies (Y4) is the most widespread pathway, with 74.3% of households reporting adoption. This reflects the rapid diffusion of mechanization services, technical support,

and digital tools in agricultural production, consistent with recent findings on technological transformation trends in the Mekong Delta (Robert & Brown, 2022).

The adoption of organic, ecological practices and Nature-based Solutions (Y2) also accounts for a relatively high proportion (59.9%), indicating a gradual shift toward more sustainable and ecologically adaptive farming systems, as emphasized in analyses of ecological agriculture and climate adaptation policies (Seijger et al., 2017; Government of Vietnam, 2017).

In contrast, land-use system transformation (Y1) shows a lower adoption rate (38.5%), suggesting that more structural changes in production systems occur more cautiously. Meanwhile, livelihood diversification (Y3) and value-chain linkage participation (Y5) are adopted at moderate levels (45.9% and 47.9%, respectively), aligning with previous observations of uneven transformation pathway choices among farm households (World Bank, 2016; Minkman et al., 2022) (Table 3.3).

#### *3.4. Livelihoods and transformation pathways*

The relationship between livelihood structure and agricultural transformation decisions provides important insight into how households in An Giang Province navigate structural change in the Mekong Delta. Different livelihood types ranging from intensive rice farming and horticulture to non-farm employment and migration are associated with varying patterns of engagement across transformation pathways, including land-use conversion, ecological/NBS adoption, diversification, digital technologies, and value-chain linkages. The statistically significant Pearson Chi-square result ( $p < 0.001$ ) indicates a strong association between livelihood orientation and transformation behavior, suggesting that livelihood assets and income strategies condition households' capacity and incentives to adopt specific transformation pathways. Table 3.4 details these associations.

Table 3.4. Association between livelihood types and agricultural transformation pathways

Livelihood types	Y1: Land-use	Y2: Ecological/NBS	Y3: Diversification	Y4: Digital	Y5: Value chain
Three-crop rice	23 (39.0%)	37 (62.7%)	55 (93.2%)	58 (98.3%)	32 (54.2%)
Two-crop rice	16 (45.7%)	26 (74.3%)	24 (68.6%)	35 (100.0%)	22 (62.9%)
Vegetables	15 (53.6%)	15 (53.6%)	8 (28.6%)	18 (64.3%)	12 (42.9%)
Fruit trees	23 (32.9%)	41 (58.6%)	5 (7.1%)	54 (77.1%)	42 (60.0%)
Machinery/business	23 (38.3%)	37 (61.7%)	32 (53.3%)	45 (75.0%)	23 (38.3%)
Non-farm	32 (39.0%)	42 (51.2%)	25 (30.5%)	69 (84.1%)	42 (51.2%)
Migration	22 (40.0%)	26 (47.3%)	23 (41.8%)	37 (67.3%)	21 (38.2%)

Pearson Chi-square = 109.456; df = 10; p < 0.001

Table 3.4 indicates a statistically significant association between livelihood type and agricultural transformation pathways ( $\chi^2 = 146.751$ ;  $p < 0.001$ ). When examined by within-group proportions, rice-producing households (double- and triple-cropping systems) tend to adopt digital technology pathways (Y4) and ecological/NBS practices (Y2) more intensively, reflecting adjustments within the existing rice-based system. In contrast, fruit-growing households show higher participation in value-chain linkages (Y5) and land-use transformation (Y1), indicating a stronger market orientation and more structural production shifts. Households engaged in non-farm employment or service-based activities demonstrate more diversified participation across multiple transformation pathways, particularly in digital technologies. This suggests that mixed livelihood structures enhance household capacity to engage in a broader range of transformation options.

### 3.5. Income levels and transformation pathways

Household income levels play a critical role in shaping the capacity and incentives of farm households in An Giang Province to engage in different agricultural transformation pathways within the Mekong Delta. Variations across high, middle, and low-income groups reveal differentiated patterns of adoption in land-use conversion, ecological/NBS practices, diversification, digital technologies, and value-chain linkages. The statistically significant Pearson Chi-square result ( $p < 0.001$ ) confirms that income status is strongly associated with transformation behavior, suggesting that financial resources and economic positioning condition

households’ ability to participate in more knowledge-intensive and market-oriented pathways. (Table 3.5)

Table 3.5. Association between household income levels and agricultural transformation pathways

<b>Income group</b>	<b>Y1: Land-use</b>	<b>Y2: Ecological/NBS</b>	<b>Y3: Diversification</b>	<b>Y4: Digital</b>	<b>Y5: Value chain</b>
<b>High income</b>	38 (37.6%)	59 (58.4%)	34 (33.7%)	101 (100.0%)	72 (71.3%)
<b>Middle income</b>	41 (60.3%)	65 (95.6%)	57 (83.8%)	68 (100.0%)	35 (51.5%)
<b>Low income</b>	20 (66.7%)	30 (100.0%)	27 (90.0%)	22 (73.3%)	16 (53.3%)

Pearson Chi-square = 146.751; df = 35; p < 0.001

Table 3.5 demonstrates a statistically significant association between household income level and agricultural transformation pathways ( $\chi^2 = 109.456$ ;  $p < 0.001$ ). Higher-income households exhibit markedly greater participation in smart agriculture and digital technologies (Y4) as well as value-chain linkages (Y5), reflecting stronger investment capacity, improved access to market networks, and greater risk-bearing ability.

Middle-income households show relatively broad engagement across multiple pathways, particularly in ecological/NBS practices (Y2) and production–livelihood diversification (Y3). This suggests a strategic balance between incremental sustainability adjustments and selective structural change.

By contrast, lower-income households participate in certain transformation forms but display limited adoption of digital technologies and formal value-chain integration. This pattern highlights the presence of resource constraints that restrict their ability to engage in more capital-intensive and market-oriented transformation pathways.

#### **4. Discussion**

##### *4.1. From Policy Phases to Differentiated Household Responses*

The findings indicate that successive agricultural policy phases in the Mekong Delta have gradually expanded the opportunity space for transformation, yet household-level responses remain heterogeneous. Qualitative evidence shows that policy priorities have shifted from food security and rice intensification toward market orientation and, more recently, climate adaptation and green transformation. However, quantitative results demonstrate that these policy shifts do not automatically translate into uniform adoption patterns among farm households.

This reinforces the view that agricultural transformation is a path-dependent and mediated process, in which macro-level policy signals interact with household-level resources and constraints (Timmer, 1988; Minkman et al., 2022). Policy frameworks create enabling conditions but do not predetermine outcomes; households select different transformation pathways depending on their livelihood strategies and economic capacity.

#### *4.2. Livelihood Structure as a Central Mediating Factor*

The strong association between livelihood type and transformation pathways (Table 4.4) underscores the central mediating role of livelihood structure. Rice-producing households primarily adopt incremental adjustment pathways particularly ecological/NBS practices (Y2) and digital technologies (Y4) which allow adaptation within the existing production system.

In contrast, fruit-growing and mixed-livelihood households exhibit higher engagement in structurally oriented and market-driven pathways, such as land-use transformation (Y1) and value-chain linkage participation (Y5).

These patterns align with livelihood diversification theory, which posits that households combine multiple activities to manage risk and capture emerging opportunities (Ellis, 2000; Barrett et al., 2001). In the Delta context, diversified and non-farm-oriented livelihoods appear to enhance households' capacity to experiment with multiple transformation pathways, whereas specialized rice systems tend to prioritize lower-risk, incremental adjustments.

#### *4.3. Income Differentiation and Uneven Transformation Outcomes*

Income stratification further explains the uneven nature of transformation outcomes. Higher-income households participate more intensively in capital- and institution-intensive pathways, particularly digital agriculture (Y4) and value-chain linkages (Y5), reflecting superior access to finance, information, and markets (Table 4.5).

Middle-income households demonstrate broader participation in ecological practices and diversification pathways, while lower-income households face clear constraints in adopting technology- and market-based transformations.

These findings are consistent with earlier evidence suggesting that agricultural transformation is not income-neutral and may inadvertently exacerbate inequality if resource constraints are not addressed (World Bank, 2016; Reardon et al., 2019). Although recent policies emphasize inclusiveness and sustainability, the results indicate that poorer households risk being confined to partial or incremental transformation pathways.

#### *4.4. Explaining the Dominance of Digital and Ecological Pathways*

The high adoption rates of digital (Y4) and ecological/NBS (Y2) pathways reflect both policy design and adoption cost structures. Compared to land-use transformation or formal value-chain

participation, these pathways typically require fewer structural adjustments and can be implemented incrementally. This helps explain their rapid diffusion across livelihood and income groups, in line with the policy emphasis on digitalization and ecological agriculture under Resolution 120 and related programs (Government of Vietnam, 2017; Robert & Brown, 2022).

Conversely, the lower adoption of land-use transformation (Y1) suggests the persistence of institutional barriers, land tenure constraints, and risk considerations particularly in rice-specialized zones where historical investments in irrigation and high-dyke systems have effectively locked households into specific production models (Kakonen, 2008; Nguyen et al., 2016).

#### *4.5. Implications for Understanding Uneven Agricultural Transformation*

Overall, the uneven pattern of agricultural transformation in An Giang Province does not necessarily reflect policy failure, but rather differences in household capacity to engage with evolving policy phases. Macro-level policy coherence does not automatically ensure micro-level convergence. Instead, transformation unfolds through multiple coexisting pathways shaped by livelihood structure and income differentiation.

This study contributes to the literature by empirically linking long-term policy phases with differentiated household-level transformation pathways, moving beyond a binary “adoption/non-adoption” framework. Conceptualizing agricultural transformation as a portfolio of pathways rather than a single linear trajectory provides a more realistic foundation for designing inclusive and context-sensitive policies in the Mekong Delta and comparable delta regions.

### **5. Conclusion**

This study analyzes agricultural transformation in An Giang Province by linking long-term policy phases with household-level transformation pathways using mixed methods (KIIs, FGDs, and household survey data). Results show that transformation in the Mekong Delta is a cumulative, policy-driven process, but outcomes remain uneven across households. Farmers pursue multiple coexisting pathways rather than a single linear trajectory. Digital agriculture and ecological/NBS practices are most prevalent, while land-use transformation and formal value-chain linkage remain limited due to institutional and market constraints. Livelihood structure and income act as key mediating factors: diversified and higher-income households adopt more capital-intensive pathways, whereas rice-dependent and poorer households make incremental adjustments.

The study contributes by integrating policy-phase analysis with micro-level evidence and conceptualizing transformation as a differentiated portfolio of pathways. However, cross-sectional data limit causal inference and generalizability. Future research should apply longitudinal and comparative designs. Overall, inclusive agricultural transformation requires not only coherent policy but also targeted support addressing livelihood and income disparities.

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