

Article

Multiple Concurrency and Path Equivalence: A Study on the Configuration Mechanism for Integrating Eco-Farms with Rural Tourism

Xia Xiao ¹, Pingan Xiang ^{2,*} , Jian Wang ³, Haisong Wang ⁴, Maosen Xia ²  and Lian Wu ⁵

¹ School of Business, Hunan University of Humanities, Science and Technology, Loudi 417000, China; 2116@huhst.edu.cn

² School of Business, Hunan Agricultural University, Changsha 410128, China; xiamaosan@stu.hunau.edu.cn

³ Human Resources Department, Hunan University of Humanities, Science and Technology, Loudi 417000, China; 2099@huhst.edu.cn

⁴ School of Innovation and Entrepreneurship, Hunan University of Humanities, Science and Technology, Loudi 417000, China; 3770@huhst.edu.cn

⁵ School of Graduate Education and Teaching Division, Hunan University of Humanities, Science and Technology, Loudi 417000, China; 25091201@huhst.edu.cn

* Correspondence: xiangpa@hunau.edu.cn

Abstract

Comprehensively integrating eco-farms and rural tourism represents a crucial pathway for advancing rural revitalization and sustainable development; however, existing research has pre-dominantly focused on the net effects of individual factors, failing to reveal the underlying complexity of multiple co-occurring factors and their interactive logics. With the aim of addressing this theoretical gap, we employ a configurational approach that integrates Necessity Condition Analysis (NCA) with fuzzy set qualitative comparative analysis (fsQCA), and data was collected from 1041 Chinese ecological farms (ecological farm operators) using a structured questionnaire, to systematically explore the integrated complex configurational driving logic. Our findings reveal that no single necessary condition independently causes high-level integration. The fsQCA results further reveal that high-level integration is attainable via two distinct, yet equivalent pathways. First, the “Endogenous–Technological–Economic Synergistic Drive Model” emphasizes the intrinsic development needs of business entities, requiring extensive synergy with external technological empowerment and the regional economic environment; second, the “re-source–market–integration linkage-driven” pathway leverages unique resource endowments and achieves value transformation through efficient resource integration capabilities, guided by clear market demand. Both pathways exhibit functional substitutability among their conditions, demonstrating strategic systemic flexibility. Additionally, in the analysis of non-high-integration configurations, we draw upon structural hole theory to categorize systemic failures caused by missing key connections or factor misalignment.

Keywords: eco-farm; rural tourism; agritourism integration; qualitative comparative analysis (QCA); configuration perspective



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1. Introduction

In the context of the global agenda for rural transformation and sustainable development, the rural development practices of emerging economies—with China as a representative example—have drawn significant attention. Due to its catalytic role, tourism is

increasingly recognized as a key driver of economic revitalization and social restructuring across numerous regions [1,2]. Amid this global trend, eco-farms, as core practitioners of ecological agriculture [3], have transcended their role as mere agricultural production units, evolving into significant tourism and leisure destinations worldwide due to their inherent health benefits, scenic esthetics, and local cultural value [4,5]. In recent years, innovative strategies underlying the integration of eco-farms with rural tourism have emerged, connecting agricultural production, ecological conservation, and community development. This approach represents not only a vital pathway for China's rural revitalization [6], but also serves as a shared global avenue for exploring rural sustainability. Research has indicated that such integration effectively optimizes rural industrial structures and stimulates endogenous economic vitality [7], promoting improved farmer livelihoods and coordinated urban–rural development [8,9] while simultaneously advancing enhancements in infrastructure and public services [10]. However, global practices also reveal common challenges; for example, despite the development of increasingly diverse integration models, many projects remain confined to superficial experiences (e.g., sightseeing and fruit picking) and face development bottlenecks including product homogenization and insufficient content innovation [11,12].

In the Chinese context, ecological farms have flourished in recent years as key vehicles for implementing green agricultural transformation, bolstered by strong national policy support. According to data released by China's Ministry of Agriculture and Rural Affairs, by 2025, 1106 ecological farms of various levels had been established nationwide. These farms are widely distributed across regions with differing resources and development levels, such as the eastern coastal areas, southwestern mountainous regions, and the Beijing–Tianjin–Hebei region. Meanwhile, rural tourism has become the primary setting for China's domestic tourism market and a key driver of rural revitalization. In 2024, both the number of rural tourism visits and related revenue reached record highs [13]. Against this backdrop, promoting the integration of eco-farms and rural tourism is widely regarded as an innovative model allows for the conversion of ecological value into economic value, achieving synchronized growth in both industrial prosperity and ecological livability. However, despite the emergence of successful models such as the Tahe-Haoshijie Smart Farm in Beixing Village, Chongming, Shanghai, and the ecological farms in Yucun, Anji, a significant number of initiatives still face superficial and homogenized challenges, such as having resources but no products, having products but no market, and offering sightseeing but lacking experiential elements. These issues directly result in low added value for farm tourism and low visitor return rates, limit impacts on farmers' incomes, and may even lead to destruction of the farm's original ecological foundation through reckless development. This may cause the "eco-friendly" gold standard to fade and plunge the venture into an unsustainable development quagmire. Therefore, systematically investigating the specific combinations of conditions that lead to the success or failure of this type of integration holds urgent practical significance for guiding the emerging nationwide practice of ecological farm transformation.

The existing literature on agritourism (or ecotourism) has largely focused on assessing economic benefits [14], summarizing development models, and exploring their macro-level community impacts [15]. However, there remains a global insufficiency regarding systematic and comparative research examining the logics of integration between eco-farms—as distinct entities with clear ecological attributes—and rural tourism. While some studies have begun to identify key drivers and analyze their independent effects (see, e.g., [3]), the mainstream research paradigm is largely confined to exploring the net impacts of or linear relationships between single factors, thus remaining disconnected from the complex reality of multi-factorial concurrences and multi-path dependencies prevalent

in global agritourism integration practices. Integration processes are often synergistically driven by multiple conditions—market forces, resources, institutions, technology—which may operate in distinct configurational forms across different geographical, institutional, and cultural contexts. Existing research has not yet systematically revealed how these cross-contextual, multi-level dynamic configurations cause differentiated integration outcomes. This global theoretical gap limits our understanding of the phenomenon's complex nature and impedes the precise alignment of practical policies.

From a comparative perspective of global practices, integration pathways can be broadly categorized into two types. One is endogenously driven, centered on local entities such as family farms or cooperatives, emphasizing small-scale, localized experiential project development [16], and deepening integration by cultivating social capital and benefit-sharing logics [17,18]; the other involves externally guided approaches led by governments or external capital, systematically building integration infrastructure and industrial chains through strategic planning, public investment, and industrial policies [15]. While these models provide macro-level classifications, they fail to explain the combinations of conditions through which endogenous momentum and external interventions can effectively couple. Do regions at different developmental stages converge toward successful configurations through distinct pathways? Answering such questions requires a research methodology which is capable of handling causal complexity and path diversity.

Considering the abovementioned issues, we propose that the integration of eco-farms and rural tourism constitutes a typical multi-factor concurrent causality problem, the success of which hinges on whether key conditions are present in specific combinations. As traditional statistical methods based on net variable effects have limitations in revealing such combinatorial effects and multiple equivalent pathways, this study integrates two cutting-edge methods—Necessity Condition Analysis (NCA) and fuzzy set qualitative comparative analysis (fsQCA)—to address these limitations [19]. NCA identifies indispensable prerequisites and their required critical thresholds, helping to establish the minimum threshold for successful integration; meanwhile, fsQCA, grounded in configurational perspectives and set-theoretic principles, identifies multiple conditional combinations that yield high integration outcomes while allowing for equivalence between different schemes. This methodological integration not only responds to the growing global interest in studying causal complexity within the social sciences, but also provides a more refined theoretical lens for analyzing the specific domain of agritourism integration.

Based on the above analysis, this study aims to address three progressively deepening core questions. (1) The Essential Conditions Problem: Among the various factors driving the integration of ecological farms and rural tourism, is there any single factor that constitutes an indispensable prerequisite for achieving a high level of integration? If it exists, what is the bottleneck level it must reach? (2) The Sufficiency Configuration Problem: Which combinations of preconditions (configurations) can sufficiently induce high-level integration? Do equivalent substitutions exist among these configurations; that is, are there multiple divergent yet equally effective driving pathways? (3) The Causal Asymmetry Problem: Are configurations inducing non-high-level integration merely simple opposites of those inducing high-level integration? What systemic failure logics do they reveal?

The contributions of this study are primarily reflected in the following three aspects: first, at the theoretical level, this study breaks through the traditional analytical paradigm of single-factor or two-variable interactions by integrating NCA and fsQCA. In this way, the complex, concurrent causal logics underlying agritourism integration are systematically revealed from a configurational perspective, identifying multiple equivalent implementation pathways. This deepens our understanding of the phenomenon's complexity and responds to the theoretical call for multi-path development and context sensitivity in

global research. Second, considering empirical evidence and knowledge accumulation, this study provides systematic evidence grounded in extensive Chinese practices. This not only enriches the global case repository on agritourism integration, but also establishes a comparative foundation for understanding the universality and particularity of integration models across different institutional and cultural contexts through the identified configuration pathways. Finally, at the methodological level, this study demonstrates the potential and value of hybrid NCA and fsQCA approaches in research on rural development and tourism, offering an analytical framework for future studies addressing similar complex socioeconomic issues.

2. Evolution of Theoretical Perspectives and Methods

2.1. Net Effects to Configuration Perspectives: A Paradigm Shift in Research Methodology

This study builds upon our research team's prior systematic exploration [3]. Employing grounded theory, we identified six core factors driving the integration of eco-farms and rural tourism, constructing an integrated framework comprising generative, development, and supporting forces. Having been validated using Partial Least Squares Structural Equation Modeling (PLS-SEM), this framework clarifies the pivotal roles of market demand and intrinsic development needs. It reveals the underlying logic of synergistic development achieved by eco-farms through leveraging the cultural value of landscapes and benefit-sharing logics, such as land equity participation and profit distribution. The framework also affirms the enabling role of technological factors while indicating that farm scale and capital have relatively limited influence.

However, the “net effects” of variables revealed by PLS-SEM reflect the statistically average independent contributions of each factor. In reality, agritourism integration is a complex social process involving the interplay and synergistic effects of multiple factors, whose causal logics exhibit typical concurrency, asymmetry, and multi-path equivalence. The PLS-SEM method faces three fundamental limitations in this context. First, due to its linearity and additivity assumptions, it struggles to capture nonlinear interactions and synergistic effects between factors [20]. Second, path coefficients cannot distinguish the asymmetric causal logic that gives rise to “high-integration” versus “non-high-integration” outcomes [21]. Third, it fails to address the core question regarding which combined conditions lead a factor to become critical [21], nor does it enable systematic identification of multiple concurrent configurations (i.e., equivalent paths) causing the same outcome or determining whether a variable is a necessary condition [22].

Therefore, although prior researchers have established a framework for determining the drivers of convergence, methodological limitations prevent it from revealing how these factors collectively produce outcomes through specific combinations; that is, the “configuration black box” of driving mechanisms remains unopened. To overcome this limitation, this study achieves a critical theoretical shift—moving from examining variables' independent “net effects” to exploring factors' concurrent “configuration effects.” Methodologically, this study introduces a hybrid analytical framework combining Necessity Condition Analysis (NCA) with fuzzy set qualitative comparative analysis (fsQCA). NCA identifies and quantifies the indispensable conditions for achieving integration and their bottleneck levels, while fsQCA further reveals how these conditions, through diverse combinations, form multiple equivalent pathways leading to high integration outcomes. This research advancement—shifting from “net effects” to “configuration pathways”—not only better aligns with the complex causal nature of agritourism integration in practice, but also offers new possibilities for constructing more explanatory theoretical frameworks and policy tools that better reflect real-world diversity.

2.2. The Theoretical Roles of Prerequisites

Based on the integration of innovation diffusion theory [23], the Resource-Based View [24], social capital theory [25], and embeddedness theory [26], we hypothesize the following roles of six conditional variables in the convergence process. Intrinsic development needs serve as the fundamental driving force for convergence and, thus, are expected to play a central role in most pathways. Intrinsic resource endowment serves as the unique foundation for integration, and is expected to occupy a central position in resource-dependent pathways. Technical support and the regional economic level constitute important external enabling conditions, potentially functioning as core levers or auxiliary supports. Market demand serves as the value realization driver for integration, potentially acting as a core orientation in certain pathways. Resource integration capability functions as the pivotal hub connecting supply and demand, with its importance expected to be prominent across all pathways, and particularly becomes a core competency in market-facing contexts. These assumptions provide a theoretical reference for interpreting the subsequent configurational analysis results.

3. Research Methods

This study aims to move beyond analyzing isolated single-factor effects, instead exploring the complex configurational pathways that enable the integration of ecological farms and rural tourism. To this end, we adopted a hybrid methodological framework integrating NCA and fsQCA. This research follows a logical progression from data foundation to specific analysis. First, we utilize the established variable system and survey data developed by our team. Second, we employ NCA to identify and quantify the threshold conditions necessary for integration. Finally, we employ fsQCA to reveal how these conditions combine to form diverse sufficient pathways. This design enabled us to both pinpoint the hard constraints of integration and systematically map multiple possibilities for its realization.

3.1. Data Sources and Variable Measurement

The empirical foundation of this study stems from a large-scale questionnaire survey previously completed by our team [3]. This survey targeted operators of ecological farms and managers of rural tourism in multiple regions across China, yielding 1041 valid responses. The sample exhibits strong regional representativeness and typological diversity.

For variable measurement, rigorously designed and mature scales were fully adopted. Based on a systematic review of this content is correct the agritourism integration literature (e.g., [citation]) alongside preliminary grounded theory findings [3], this study operationalizes the outcome variable—integration level between eco-farms and rural tourism—into a three-dimensional composite measurement index. Specifically, it encompasses Mutual Promotion and Win–Win Development (“The eco-farm and rural tourism mutually promote each other, achieve mutual benefits and win–win outcomes, and develop in a coordinated manner”), Value Extraction (“The tourism and leisure value of the eco-farm has been extracted”), and Product Enrichment (“The development of the eco-farm has made the region’s ecotourism products more diverse and abundant”). These three items collectively reflect the degree of agritourism integration across three dimensions: Relational synergy, value transformation, and industrial impact.

All items were measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach’s α coefficient for the scale used in the study was 0.839, the composite reliability (CR) was 0.877, and the average variance extracted (AVE) was 0.704 [3], indicating good reliability. In subsequent analyses, the mean of the three items was used as the integration score for the farm.

The conditional variables encompass six core drivers: Market demand, Regional economic level, Intrinsic development needs, Intrinsic resource endowment, Technical support, and Resource integration. All variables were measured using a 5-point Likert scale, with their reliability and validity having been validated in prior research [3]. The scores for each construct were calculated by averaging the scores of multiple items within it. Therefore, the descriptive statistics (see Table 1) reflect the distribution of the construct's mean value.

Table 1. Sets, calibrations and descriptive statistics.

Assembly	Sample Size	Fuzzy Set Calibration			Descriptive Analysis			
		Not Affiliated at All	Intersection	Wholly Subordinate	Minimum Value	Maximum Value	Average Value	Standard Deviation
DOI	1041	3.333	4.000	4.667	1.000	5.000	3.903	0.963
IRE	1041	3.167	3.833	4.167	1.000	4.833	3.605	0.831
IDN	1041	2.917	3.750	4.187	1.666	4.625	3.518	0.794
TF	1041	3.281	3.875	4.375	1.000	4.875	3.693	0.855
MD	1041	2.833	3.500	4.000	1.111	4.555	3.431	0.750
Rel	1041	3.208	3.833	4.333	1.000	4.833	3.685	0.826
RE	1041	3.182	3.708	4.075	1.133	4.500	3.543	0.718

Note: All constructs were measured using multiple 5-point Likert scale items. The minimum, maximum, mean, and standard deviation reported in the table represent descriptive statistics for the mean of the items included in each construct. Therefore, the maximum value of the mean variable may be less than the original scale's top value of 5.

3.2. Data Analysis

To systematically unravel the complex causal logics underlying convergence, we sequentially employed two complementary analytical techniques. First, we utilized NCA to identify key preconditions. The core of NCA lies in determining necessary relationships where “without this condition, the outcome would not occur” [22]. This method employs an “upper bound technique” to delineate an envelope around the scatter plot of conditions and outcomes, distinguishing the observed region from the theoretical “void zone,” and the effect size (d) is calculated to quantify the constraint imposed by the condition. A significant effect size greater than zero indicates that the condition is necessary for the outcome to occur. Bottleneck analysis further reveals the minimum thresholds that each condition must meet to achieve a specific integration outcome. This study employs the highly flexible CR-FDH technique to calculate effect sizes and determine bottleneck levels [27].

Subsequently, fsQCA was employed to explore sufficient configurations. Grounded in set theory and Boolean algebra, fsQCA excels at analyzing multiple concurrent condition combinations that cause identical outcomes [28,29]. Its analytical process primarily involves constructing truth tables, filtering configurations based on case frequency and consistency thresholds, and obtaining simplified, intermediate, and complex solutions for interpretive outcomes through logical minimization algorithms [30]. fsQCA effectively reveals multiple equivalent pathways causing high- or non-high-integration outcomes while acknowledging the asymmetry of causal relationships. By integrating NCA and fsQCA, we first precisely anchor the indispensable necessary conditions for convergence, then review how these conditions synergistically combine with other factors to form diverse sufficient driving pathways, thereby more comprehensively revealing the underlying complex causal logics [19,31].

4. Analysis Results

4.1. Variable Calibration

Following the standard procedure of fsQCA, we first calibrated all continuous variables into fuzzy set membership scores [29], with the aim of establishing anchor points based on theory and data distribution, transforming raw measurements into set membership degrees ranging from 0 (complete non-membership) to 1 (complete membership). This serves as a prerequisite for subsequent set relationship operations. Drawing on established research [30], we established three qualitative anchor points—full membership, intersection, and full non-membership—for the outcome variable (level of integration of eco-farms and rural tourism) and six condition variables (internal development needs, internal resource endowment, technical support, regional economic level, market demand, and resource integration). Specifically, the upper quartile (75th percentile), median (50th percentile), and lower quartile (25th percentile) of the sample's descriptive statistics were used as these three anchors [32], with calibration transformations performed using a logistic function. Calibration for the non-high-fuzziness result set was achieved by logically inverting the membership scores of high fuzziness (1—membership). Specific calibration anchors and descriptive statistics for each variable are detailed in Table 1.

4.2. Identification of Necessary Conditions

Before exploring combinations of multiple sufficient conditions, it is theoretically important to identify the necessary conditions that cause the outcome. Labeling a condition as necessary implies that the outcome will inevitably fail to materialize in its absence. The NCA method precisely identifies such conditions and assesses their required critical thresholds by quantitatively analyzing the “bottleneck effect” [22].

We employed two mainstream techniques—CR (Regression Upper Bound) and CE (Envelope Upper Bound)—to calculate the effect size (d) for each condition; in particular, the effect size values range from 0 to 1, with higher numbers indicating stronger constraints on the outcome. According to methodological standards, a practically significant necessary condition is defined if it has an effect size $d \geq 0.1$ and simultaneously passes the Monte Carlo simulation replacement test ($p < 0.05$) [33,34].

The analysis results (see Table 2) indicate that the effect sizes for all six antecedent conditions fell below the critical threshold of 0.1 and failed to meet statistical significance ($p > 0.05$). Specifically, although the effect size of technical support was the largest under both methodologies, it remained far below 0.1 and was non-significant. This implies that no single condition within the study sample constituted an absolute barrier to the integration of eco-farms and rural tourism. Theoretically, this implies that integration does not depend on the mandatory presence of any single factor, providing preliminary evidence for the existence of multiple concurrent causation and equivalent pathways.

To further explore the incremental constraints of conditions on outcome levels, we conducted a bottleneck level analysis. The bottleneck level refers to the minimum level that a condition (X) must attain to achieve a specific outcome level (Y) [35]. Table 3 shows that, when targeting a 70% integration level, all five conditions—with the exception of technical support—exhibited a bottleneck level of 0%, while technical support demonstrated an exceptionally low bottleneck level of 0.7%. This further corroborates the conclusion that the constraint imposed by any single condition is relatively weak; Furthermore, although technical support may play a foundational role in driving integration toward higher levels, its individual impact remains limited.

Table 2. Analysis results of the necessary conditions.

Conditions ^a	Method	Accuracy	Ceilingzone	Scope	Effect Size (d) ^b	p-Value ^c
IRE	CR	100%	0.000	0.99	0.000	1.000
	CE	100%	0.000	0.99	0.000	1.000
IDN	CR	100%	0.000	0.99	0.000	1.000
	CE	100%	0.000	0.99	0.000	1.000
TF	CR	98.5%	0.006	0.99	0.006	<0.001
	CE	100%	0.008	0.99	0.008	0.336
MD	CR	100%	0.000	0.99	0.000	1.000
	CE	100%	0.000	0.99	0.000	1.000
Rel	CR	100%	0.004	0.99	0.004	<0.001
	CE	100%	0.007	0.99	0.007	0.458
RE	CR	100%	0.000	0.99	0.000	1.000
	CE	100%	0.000	0.99	0.000	1.000

Note: a. Fuzzy set membership values after calibration. b. $0.0 \leq d < 0.1$: “Low level”; $0.1 < d < 0.3$: “Medium level”. c. Permutation test in NCA (re-sampling count = 10,000), 0.000 indicates less than 0.001.

Table 3. Results of the bottleneck level (%) analysis of the NCA software.

DOI	IRE	IDN	TF	MD	Rel	RE
0	NN	NN	NN	NN	NN	NN
10	NN	NN	NN	NN	NN	NN
20	NN	NN	NN	NN	NN	NN
30	NN	NN	NN	NN	NN	NN
40	NN	NN	0.2	NN	NN	NN
50	NN	NN	0.5	NN	0.3	NN
60	NN	NN	0.7	NN	0.5	NN
70	NN	NN	1.0	NN	0.7	NN
80	NN	NN	1.2	NN	1.0	NN
90	NN	NN	1.4	NN	1.3	NN
100	NN	NN	1.7	NN	NN	NN

Note: CR method, NN = Not Necessary; Software version used: R-4.5.2.

4.3. Multi-Path Recognition of High and Non-High Integration

Based on the calibrated data, we systematically analyzed multiple reconfigurations causing high- and non-high-integration outcomes using the fsQCA method. Regarding the parameter settings, theoretical inclusiveness was balanced with result rigor by setting the case frequency threshold to 1 in this study. Although our total sample size of 1041 cases qualifies as a large-scale study, the core logic of fsQCA lies in identifying meaningful conditional configurations rather than statistical inference. In this regard, setting the frequency threshold to 1 helps to retain unique, valid cases and prevents valuable configurations from being omitted [29]. The raw consistency threshold was set at 0.8 (a standard practice in fsQCA studies), ensuring strong subset relationships between the included configurations and outcomes. The PRI consistency threshold was set at 0.70 to effectively distinguish configurations inducing high convergence from those that do not, preventing confusion of simultaneous subset relationships [36]. In this study, among the $2^6 = 64$ logically possible configurations, a frequency threshold screening identified 42 configurations with at least one empirical instance, while the remaining 22 configurations were designated as logical remainders, which were employed as counterfactual cases in the construction of intermediate solutions. In the counterfactual analysis, based on prior research [3] and theoretical assumptions, it was explicitly hypothesized that each of the six conditions—namely, high levels of internal development demand, resource endowment, technological support,

market demand, resource integration capability, and regional economic level—contributes positively to the emergence of high integration outcomes. Therefore, in constructing intermediate solutions, all conditions were posited as potentially present and exerting a positive influence on the outcome, while simultaneously allowing for the logical possibility of condition absence within the counterfactual analysis to ensure parsimony of the solutions.

By comparing intermediate solutions with simplified solutions, we distinguished core conditions (those exerting a strong influence on the outcome) from peripheral conditions (those playing auxiliary roles) within each pathway. The analysis identified five sufficient configurations leading to high integration (overall solution consistency = 0.88, coverage = 0.41) and four sufficient configurations leading to non-high integration (overall solution consistency = 0.85, coverage = 0.55). The configurations for high and non-high integration exhibited asymmetry, confirming the complexity of their driving logics.

4.3.1. Achieving Highly Integrated Multi-Equivalent Paths

The five highly integrated configurations identified through analysis can be summarized into two equivalent pathways with clear theoretical implications, based on their core logic (see Table 4).

Table 4. High and non-high DOI configurations are implemented in fsQCA.

Conditions	High DOI					Non-High DOI					
	S1a	S1b	S2a	S2b	S2c	NS1a	NS1b	NS2	NS3	NS4a	NS4b
IRE	●		●	●	●		⊗	⊗		⊗	●
IDN	●	●	●	●		⊗	⊗	⊗	●	⊗	⊗
TF	●	●	●		●	⊗	⊗	⊗			●
MD		●	●	●	●	⊗		⊗	⊗	⊗	
Rel	●	●		●	●	⊗	⊗		⊗	⊗	⊗
RE		●	●	●	●				⊗	●	⊗
Consistency	0.91	0.94	0.92	0.94	0.93	0.91	0.89	0.90	0.85	0.90	0.88
Original Coverage	0.24	0.19	0.18	0.17	0.18	0.29	0.26	0.27	0.18	0.14	0.11
Unique Coverage	0.10	0.05	0.04	0.03	0.04	0.04	0.04	0.06	0.09	0.02	0.04
Overall Consistency			0.88						0.85		
Overall Coverage			0.41						0.55		

Note: ● = Core condition present; ⊗ = Core condition absent; ● = Marginal condition present; ⊗ = Marginal condition absent.

Pathway One: Economy–Technology–Domestic Demand-Driven Pathway. This avenue forms an indispensable core combination of three elements: High intrinsic development needs, robust technical support, and superior regional economic level (as shown in configurations S1a and S1b). This combination represents a core triangular architecture jointly constructed by strong endogenous momentum, external technological empowerment, and macroeconomic conditions. Building upon this stable triangle, internal resource endowments (S1a) and vigorous market demand coupled with resource integration capabilities (S1b) serve as complementary peripheral conditions, each driving convergence. This finding indicates that, for farms located in economically active zones that possess strong intentions to upgrade and technological foundations, success can be achieved either by leveraging unique internal resources to create markets or by keenly capturing and integrating external market demand. These two strategies exhibit functional equivalence under certain circumstances.

Pathway Two: Resource–Market–Integration-Driven Pathway. The core of this direction lies in a stable, triangular driving architecture composed of three elements: Prominent internal resource endowments, clear market demand, and efficient resource integration capabilities (as illustrated in configurations S2a, S2b, and S2c). This combination em-

phasizes leveraging high-quality core resources, adopting a market-oriented approach, and transforming potential into products through effective organizational integration. Notably, in addition to this core combination, three types of condition—technical support, intrinsic development needs, and regional economic level—exhibit multiple rich substitution relationships; as such, they can be paired (e.g., technology–internal demand, technology–economy, or internal demand–economy) as auxiliary conditions to support the core “steady-state triangle.” This reveals that, with solid resource and market foundations, a highly integrated support system can be flexible. Different regions can strategically address their weaknesses by selecting distinct combinations of auxiliary conditions for reinforcement.

4.3.2. Configuration and Failure Logics Causing Non-High Integration

The configurations that fail to achieve high integration (see Table 4) are not merely the opposite of high-integration configurations; rather, they reveal systemic dysfunction or the absence of critical elements. These configurations can be primarily categorized into two typical “malfunction” patterns.

Pattern One: Collapse of the Core Driving Structure. This is particularly evident in the corresponding failure configurations of the highly integrated path centered on “economy–technology–domestic demand” (e.g., NS1a, NS1b, or NS2). For instance, even with resource or market advantages, integration struggles to advance regardless of regional economic level if both intrinsic development needs and technical support are absent. This demonstrates the indispensability of this core triangle; in particular, the collapse of any key pillar can render the entire driving system ineffective.

Pattern Two: Severe Mismatch Among Factors and Silo Effects. Another category of failure stems from the inability of factors to form effective synergies (e.g., NS3, NS4a, or NS4b), such as relying solely on technical support (NS3) without market demand or resource integration, or depending exclusively on market demand or external resources (NS4a and NS4b) without internal momentum. These configurations demonstrate that possessing individual advantageous conditions does not guarantee success. Without complementary combinations of other factors, such conditions may instead lead to ineffective investments or hindered development.

4.4. Robustness Test

To ensure the reliability of the research findings, we conducted a series of robustness tests. Adjust the consistency threshold: Increase the original consistency threshold from 0.8 to 0.85, ensuring consistency and coverage alignment for core configurations and overall solutions. Increasing the PRI consistency threshold from 0.7 to 0.75 resulted in the core configuration (the combination of core conditions for both paths) still appearing stably. The overall solution’s consistency decreased slightly while coverage improved marginally, aligning with expectations (see Table A1). The above tests indicate that the core condition combinations of the two core pathways identified in this study—the “endogenous–technology–economy-driven” pathway and the “resource–market–integration-driven” pathway—remain consistently stable. Only the composition and coverage of peripheral conditions exhibit slight fluctuations, demonstrating the robust validity of the research findings.

5. Discussion

This study transcends the exploration of single-variable net effects common to traditional regression analysis. By integrating NCA and fsQCA methodologies [22,37], it systematically dissects the complex dynamic logics underlying the integration of ecological

farms and rural tourism based on configurational and concurrent causality. Our findings reveal that high-level integration does not follow a singular formula but is achieved through two differentiated, yet internally resilient equivalent pathways. Conversely, integration failure stems from systemic coordination breakdowns caused by critical structural holes. This section delves into the profound theoretical implications of these discoveries, situating them within the broader academic discourse to construct a preliminary multi-path configurational framework, based on which systematic implications for both research and practice are distilled.

5.1. Theoretical Integration of Core Findings: From Factor Lists to System Logic

Pioneering foundational research [3] provided us with a critical list of factors and their fundamental interrelationships. The contribution of this study lies in utilizing configurational analysis to reveal how these factors are embedded within and drive a complex adaptive system. The core characteristic of this system is its multi-stability—it can achieve the same high level of integration through different combinations of core conditions.

(1) A Highly Integrated Dual-Engine Model: Complementary Rather Than Opposing Development Logics

This study revealed two core pathways—the “endogenous–technology–economy–driven” pathway and the “resource–market–integration–driven” pathway—which reveal two distinct, yet complementary stable states and developmental logics within the system of agritourism integration.

The first pathway may be considered the micro-level manifestation of innovation-driven development and the new endogenous development theory [38,39]. While fundamentally driven by the intrinsic development needs of business entities, the effective operation of this endogenous engine strictly depends on the synergistic interaction of two external levers: Technological empowerment and regional economic environment. This finding not only advances the new endogenous development theory from a macro-level concept to an operational logic, but also reinterprets the essence of endogeneity—it is not a closed, self-contained system but, rather, a strategic capacity of the subject to proactively identify, absorb, and transform critical external resources (e.g., technology and capital) [40]. The differences between configurations S1a and S1b further indicate that, through this pathway, the system can dynamically adapt via sub-patterns such as supply creating demand or demand deepening iteration, demonstrating structural resilience based on differences in resource endowment. The process logic of this pathway can be summarized as follows: endogenous momentum activation → external leverage mobilization → synergistic value creation. Specifically, a business entity’s strong desire for innovation and development (endogenous) drives it to proactively seek and adopt advanced technologies (technology). Through fully leveraging the favorable economic conditions and policy environment of its region (economic), it effectively leverages technology and capital to transform agricultural resources into high-value-added tourism experience products. This achieves an innovative leap from traditional production to an “agriculture + tourism” model. This pathway embodies the logic of innovation-driven leaps propelled by endogenous momentum under externally enabled conditions, forming a complementary strategic landscape to the resource-dependent pathway discussed below.

The second pathway aligns more closely with the logic of resource-based views and industrial ecosystem construction [24,41], achieving the critical leap from static resource ownership to dynamic market value. This transition relies heavily on resource integration capabilities, as the pivotal mechanism for transformation [42]. The robustness of this path is prominently reflected in the functional redundancy and substitution flexibility of external auxiliary conditions beyond the core “resource–market–integration” triangular

structure; for instance, technology, domestic demand, and economic level can be pairwise combined to form multiple supporting configurations. Such a design, in which multiple auxiliary conditions can substitute for one another and collectively support the core structure, constitutes a vital strategy to address external uncertainties in complex systems [30] and implies that successful practices along this pathway are not singular optimal solutions but, instead, robust adaptive entities supported by multiple backup schemes. The process logic can be summarized as follows: Resource Value Identification → Integration Capability Transformation → Market Demand Alignment. Starting from the farm's unique natural or cultural resources, robust organizational integration capabilities (e.g., cooperatives or enterprise platforms) are leveraged to systematically package and productize fragmented, static resources. This enables precise alignment with and fulfillment of specific niche market demands, achieving the critical leap from “resource advantage” to “market dominance.”

It should be noted that these two pathways are not mutually exclusive binary options but, rather, complementary equilibria that have evolved under different initial conditions and regional contexts [43]. The condition variables constituting these two paths are not entirely isolated or mutually exclusive; for instance, while the “advantageous resources” in Path Two are grounded in natural and historical endowments, their value discovery and functional enhancement as tourist attractions may also require the economic investment and technological applications emphasized in Path One (e.g., trail construction, landscape design, online presentation). Similarly, the “endogenous development needs” in Path One often stem from operators' recognition of the latent value of their resources. Thus, these paths do not represent mutually exclusive dichotomies but, instead, can be considered as archetypal idealized combinations of driving forces; in practical cases, hybrid configurations between them may emerge. This study aims to identify two core logics that converge most strongly and exhibit the highest statistical and theoretical significance among numerous possibilities, respectively emphasizing “leveraging external drivers from within” and “enhancing integration and transformation from existing to superior,” thus representing distinct strategic starting points and evolutionary focuses. This distinction helps policymakers and operators to conduct more precise self-diagnosis and strategic positioning, without negating the dynamic interconnections between these elements.

(2) Structural Hole Interpretation of Non-High-Integration: A Diagnostic Framework for Systemic Failure

Drawing on Burt's (1992) structural hole theory [44], we conceptualize the value flow channel between eco-farms and the rural tourism market as a social network, in which “structural holes” refer to missing critical links connecting farm production to tourism consumption. “Bridges,” meanwhile, denote functional connections that span these structural gaps to enable efficient value flow and transformation, which can manifest as market channels, integrated entities (e.g., cooperatives or causing companies), brand IP, digital platforms, and other functional links. Our analysis of non-high-integration configurations not only confirms the “causal asymmetry” emphasized by the QCA method [29] but, more importantly, provides a diagnostically valuable analytical framework for understanding systemic failures in agritourism integration. Drawing on the structural hole perspective from social network theory [44], this study attributes integration failure to the absence of critical bridging connections within the system—a deficiency that prevents value from effectively flowing and transforming between agricultural production and tourism consumption [45]. Specifically, we identify three typical failure patterns, as detailed below.

The first type is bridge-deficit failure, characterized by the absence of any effective “bridge” connecting farms to markets—be it specialized market channels, integrated operational entities, or efficient digital platforms—resulting in a disconnect between agriculture and tourism despite shared resource reserves. A classic manifestation of this failure is

regions that are endowed with premium natural landscapes or distinctive agricultural products, yet are chronically unable to attract tourists or sell their produce, remaining trapped in a state of “abundant poverty.” In terms of configuration analysis, this type of failure fundamentally stems from the simultaneous absence of Market demand and Resource integration capabilities. Remedial strategies should focus on “bridge-building”—that is, prioritizing the introduction or construction of external bridges, such as attracting investment to bring in professional tourism operators or establishing strategic partnerships with major OTA platforms—thereby filling critical structural gaps with external forces.

The second type is precarious bridge support failure, characterized by the presence of a “bridge” that is fragile and unable to sustain stable value flow. This failure results from a sole reliance on isolated highlights (e.g., festivals or viral check-in spots) as connection points, thus lacking the structural support of Resource integration and sustained market operation capabilities [46]. This explains why farms that invest heavily in creating “viral” attractions often fade into obscurity after brief bursts of hype, failing to generate sustained visitor traffic and revenue. At the configuration level, this failure corresponds to reliance on a single technology or isolated activity, lacking the supporting capabilities of integration and sustained operations. Remediation strategies should focus on “reinforcement”; namely, shifting from singular highlights to systematic capacity building. For instance, while introducing technological facilities, local market operations and Resource integration teams should be simultaneously cultivated to transform fragile “dangerous bridges” into “passable roads” that are capable of sustaining continuous traffic flow.

The third type is isolated failure, where the farm itself functions as an “island” cut off from the flow of information, resources, and opportunities, lacking any effective network connection points in its surroundings [47]. Such areas possess neither outstanding resource endowments nor critical connectivity capabilities, often relegating them to the “periphery” of rural tourism development. They cannot benefit from the spillover effects of core scenic areas nor independently attract external investment, and thus face the risk of increasing marginalization. From a configuration perspective, this type of failure corresponds to a dual lack of resource endowment and connectivity capacity. In this scenario, the remedial strategy lies primarily in “networking”; that is, transforming the “island” into a node within a regional network through regional brand sharing, tourism route integration, and joining regional cooperative alliances, enabling the gradual cultivation of capabilities by leveraging the externalities of the network, rather than continuing to operate in isolation.

The significance of this diagnostic framework lies in its ability to transform commonly encountered developmental challenges in practice from vague descriptions into identifiable, actionable structural issues. This enables a shift in policy and practice from blanket support to targeted, precision interventions addressing specific types of market failure [48], thereby effectively addressing the critical pain points and core issues of systemic coordination. Theoretically, this framework deepens the understanding of agritourism integration failure beyond the traditional “factor deficiency theory” (lack of capital, technology, or talent) to a “relational deficiency theory” (lack of connections, networks, or embeddedness), offering a new cognitive lens for comprehending the structural challenges in rural development. It is important to emphasize that these two pathways are not mutually exclusive, and hybrid configurations may exist in practice. The identification undertaken in this study aims to elucidate the two ideal types that exhibit the greatest statistical significance and theoretical explanatory power, thereby providing a reference framework for practical diagnosis rather than exhaustively encompassing all possible variations.

5.2. Theoretical Contributions

This study advances research on agritourism integration and related fields through three progressive theoretical dimensions. First, it shifts paradigms from variable- to system-oriented approaches. By transitioning from examining the net effects of independent variables [3] to investigating the configurational effects of multiple variables [30,49], we demonstrate that understanding complex phenomena such as agritourism integration requires a systems-based approach which is capable of capturing interactions, substitutions, and concurrent factors, thus addressing the longstanding call within management and rural studies to move beyond simplistic explanations [50]. Building upon this foundation, we further refined the theoretical framework, deepening the previously proposed six-factor universal dynamic model into a contextual typology framework comprising two core pathways and their subtypes [51]. This framework not only clarifies what constitutes success but also specifies which types of success are appropriate for which contexts, significantly enhancing the theory's explanatory and predictive power while providing a clear blueprint for subsequent comparative studies and empirical testing. Ultimately, at the logic level, this study reveals that core factors play conditional roles, where the importance of any single factor is not constant but, instead, depends on its overall configuration [49]; for instance, market demand serves as a core condition in one pathway but can be substituted in another. The role of technical support also varies across pathways. This finding profoundly highlights the contextual dependency of factor effects [52], cautioning scholars against making absolute judgments about factor importance in a manner divorced from specific contexts.

5.3. Practical Implications

The configurational analysis results of this study provide different stakeholders with a “development diagnosis” and “strategic navigation” tool based on configurational thinking [30].

First, for eco-farm operators, we provide a three-step strategic diagnosis. Strategic decision-making grounded in systems thinking differs from simple benchmarking, emphasizing the systematic examination of both internal capabilities and external conditions [30]. Specifically, operators can follow the three steps listed below.

Step One: Self-Positioning and Identifying the Dominant Path. Business operators should first diagnose their core strengths by comparing themselves against the key criteria of the two core paths, asking themselves “Do I possess a strong desire for innovation and intrinsic motivation?” (closer to Path One) and “Do I possess unique and irreplaceable natural resources or cultural assets?” (closer to Path Two). Answering these questions helps to determine their strategic starting point.

Step Two: Identify Weaknesses and Pinpoint Critical Bottlenecks. Based on the determined positioning, missing key conditions can then be identified. Path One candidates should focus on diagnosing whether the two external levers—“technology” and “regional economic environment”—are attainable, while Path Two candidates should reflect on whether their “resource integration capabilities” can shoulder the responsibility of connecting to the market, as well as whether the target “market” is clearly defined.

Step Three: Proactively Build Bridges to Create Complementary Networks. Based on the identified weaknesses, the operators should then actively seek external partnerships. For those lacking technology, connect with research institutes or tech companies; for those lacking market channels, seek professional tourism operators or e-commerce platforms; for those lacking integration capabilities, consider joining cooperatives or hiring professional managers. The core of this strategy lies not in possessing all elements, but in integrating into a complementary network that compensates for any inherent weaknesses. By “building

bridges” to fill critical structural holes [44], entities can define their role within a broader industrial ecosystem [53].

Second, for policymakers, tailored strategies can be implemented based on the identified configuration. In this regard, the key insight lies in shifting from pursuing universally applicable best practices to implementing configuration-based differentiated means of empowerment [54].

For regions with “innovation-endogenous” potential, policy focus should shift from direct subsidies to establishing technology–capital–information matching platforms, thereby catalyzing the coupling of internal development needs with external enabling resources [55]; for instance, establishing agricultural technology venture capital guidance funds to support the creation of industry–academia–research collaboration bases.

For regions with “Resource integration-driven” potential, policy priorities should shift toward investing in “bridge” construction and capacity building, aiming to bridge the structural gap between resources and markets [56]; for instance, an “Industrial Integration Bridge Fund” could be established to finance collaborative projects between resource owners and market channel operators, or a “Rural Development Diagnostician” system could be promoted to enhance communities’ self-diagnostic and resource integration capabilities.

For different types of “disconnected” regions, targeted solutions should be implemented: For “bridge-deficient” areas, attracting investment and expertise should be prioritized. For “dilapidated bridge-supported” areas, sustained capacity-building support should be provided. Finally, for “isolated island” areas, the primary task is integration into regional development plans and tourism routes to achieve “network connectivity.”

Accordingly, the evaluation metrics for policy effectiveness must shift from focusing solely on economic output to assessing whether policies have effectively facilitated the formation of key regional conditions and enhanced overall systemic coordination capabilities [57].

Third, travel intermediaries and platforms may serve as “super bridges.” The strategic value of online travel platforms, travel agencies, consulting firms, and other intermediary entities as key “structural hole” fillers should be recognized and leveraged [44], with these entities not merely acting as passive sales channels but becoming proactive co-creators of value. By proactively developing specialized products for eco-farms and offering one-stop services—from product design and brand packaging to standard implementation and channel marketing—these “super bridges” can effectively connect dispersed farm supply with fragmented Market demand [45]. This approach empowers rural areas while simultaneously opening new business growth opportunities for intermediaries, achieving a win–win outcome of commercial and social value.

5.4. Research Limitations and Future Prospects

This study has several limitations, providing promising directions for future research. First, due to the study’s reliance on cross-sectional data, only a static snapshot of group configurations at a specific point in time is presented, thus failing to reveal the dynamic temporal evolution of different pathways. Future research could employ longitudinal QCA designs or incorporate process-tracing methods to explore the transitions, lock-in, or evolutionary logics among configuration pathways, thereby addressing the more dynamic question of how pathways form and transform. Second, this study primarily focuses on meso- and micro-level conditions at the farm and community levels, without fully considering broader macro-level external environments and trend-related factors. Future research should incorporate macro-level variables such as digital infrastructure penetration, climate change adaptation policies, structural shifts in consumer markets, and

integration into national tourism networks to examine their roles in triggering, moderating, or constraining different configuration pathways. Finally, the empirical foundation of this study is rooted in China's specific institutional environment, cultural traditions, and stage of economic development. China's strong government leadership, rapid land system reforms, and unique urban–rural dual structure may have shaped the distinct configurational pathways identified in this research. Therefore, particular caution is warranted when unconditionally generalizing these findings to countries or regions with different political systems, land ownership structures, or cultural contexts. Future research could involve comparative configurational analyses across nations; for instance, comparing cases from China with others from Southeast Asia, Europe, or Latin America in order to determine the conditions under which the configurational pathways identified in this study remain valid, and which combinations of conditions are context-specific. This would help to develop more refined, universally applicable meso-level theories and clarify the boundary conditions regarding their validity.

6. Conclusions

In this study, we employed a configurational theory and complexity–causality framework, combining Necessity Condition Analysis (NCA) with fuzzy set qualitative comparative analysis (fsQCA) to systematically examine and theoretically reconstruct the driving logics underlying the integration of eco-farms and rural tourism in the Chinese context. Through a configurational analysis of multi-province case studies, this research reveals the “multiple concurrent causality” underlying the integration phenomenon and successfully expands the previously established linear dynamic model into a multi-path integration framework with greater explanatory power for real-world contexts.

The core findings confirm that no single prerequisite or universally optimal pathway exists for achieving high levels of agritourism integration, with the NCA results indicating that no single factor constitutes an absolute bottleneck for integration. The fsQCA results further identified five equivalent configurations which are capable of fully inducing high integration along two differentiated core driving pathways: the “endogenous–technological–economic synergistic drive” and the “resource–market–integration synergistic drive.” The former reveals how integration is achieved through dual empowerment by technology and regional economic capital under the dominance of intrinsic development needs, deepening the micro-logic of new endogenous development theory. Meanwhile, the latter elucidates the specific pathways through which advantageous resources are transformed into tourism products under the traction of market demand and the catalysis of integration capabilities, integrating the resource endowment perspective with industrial ecosystem theory. Both pathways exhibit functional internal substitution of conditions and strategic flexibility, theoretically explaining the fundamental reasons behind the rich diversity observed in agritourism integration practices in China. It is important to emphasize that the findings of this study reveal a multi-faceted configuration of conditions which are conducive to achieving high integration, based on set-theoretic associations derived from cross-sectional data. Future studies should adopt longitudinal designs or process-tracing methods to further validate the underlying dynamic causal logics. (Supplementary Material Table S1: Truth Table) Supplementary materials have been provided for further clarification.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/agriculture16060675/s1>, Table S1: truth table.

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Institutional Review Board Statement: Ethical review and approval were waived for this study due to the study did not involve animal experiments or human clinical trials. All respondents participated voluntarily and gave their written informed consent by the Declaration of Helsinki, as well as their commitment to keep their personal information confidential and ensure anonymity. The study was approved by the college and was done under the supervision of the college.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the protection of the personal privacy of the respondents.

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Abbreviations

The following abbreviations are used in this manuscript:

QCA	Qualitative Comparative Analysis
fsQCA	Fuzzy set QCA
NCA	Necessary Condition Analysis
PLS-SEM	Partial Least Squares Structural Equation Modeling
ED	Experiential Demand
AD	Authenticity Demand
LD	Leisure Demand
RI	Regional Infrastructure
EDL	Economic Development Level
EBs	Economic Benefits
SBs	Social Benefits
EBs	Ecological Benefits
BB	Brand Building
BS	Business Scale
CaRs	Capital Resources
DT	Digital Technology
IC	Industry-academia Collaboration
CuRs	Cultural Resources
ERs	Ecological Resources
PRs	Policy Resources
DOI	Degree Of Integration

Appendix A

Table A1. Robustness test to increase the PRI consistency threshold.

Conditions	High DOI (Frequency Threshold Set to 1, PRI Consistency at 0.7)					High DOI (Frequency Threshold Set to 1, PRI Consistency Improved to 0.75)					
	S1a	S1b	S2a	S2b	S2c	S1a''	S1b''	S1c''	S2a''	S2b''	S2c''
IRE	●		●	●	●	●	●	●	●	●	●
IDN	●	●	●	●		●	●		●	●	
TF	●	●	●		●	●	●	●		●	●
MD		●	●	●	●			●	●	●	●
Rel	●	●		●	●	●	●	●	●		●
RE		●	●	●	●		●	●	●	●	●
Consistency	0.91	0.94	0.92	0.94	0.93	0.93	0.94	0.93	0.92	0.94	0.94
Original Coverage	0.24	0.19	0.18	0.17	0.18	0.19	0.17	0.18	0.18	0.17	0.19
Unique Coverage	0.10	0.05	0.04	0.03	0.04	0.05	0.03	0.04	0.04	0.03	0.05
Overall Consistency			0.88						0.88		
Overall Coverage			0.41						0.39		

Note: ● = Core condition present; ● = Marginal condition present.

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