

Article

Structural Integration of Rural Governance Networks under Issue Differentiation: Relational Differentiation, Positional Alignment, and Cross-Period Persistence in Six Ethnic Village Groups (A–F) in Southwest China

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Abstract: Rural governance consists of multiple issue-specific relations: information consultation, production assistance, public cooperation, major-decision influence, and dispute mediation each occupy distinct action contexts and may involve different contacts. Existing scholarship usually interprets the integration of governance networks through tie reuse or the linkage of formal organizations, but seldom asks how integration remains possible once issue relations have differentiated. Drawing on three-wave multilayer nomination data from 270 roster-fixed actors in six ethnic village groups of the study region, this article distinguishes tie-level edges from actor-level positions. Cross-layer edge Jaccard similarity among the five public-affairs relations ranges only from 0.034 to 0.044, indicating substantial differentiation of concrete ties. Cross-layer in-degree Spearman correlations, however, average 0.476 to 0.539, exceeding stratified permutation benchmarks that preserve village group, ethnicity, and role composition; the cross-period Spearman correlation of the composite positional ranking exceeds 0.737. Network integration therefore does not require the same edge to carry multiple functions; it can take the form of different issues converging on similar actor positions. The analysis moves the study of network integration from relational content to the level of social position.

Keywords: Rural Governance; Multilayer Networks; Relational Multiplexity; Network Integration; Ethnic Minority Regions; China

1. Introduction

The integrative character of grassroots governance is usually understood through organizational cooperation, institutional linkage, or the reuse of existing ties. In practice, however, village governance involves distinct issues such as information consultation, production assistance, public cooperation, major-decision influence, and dispute mediation. Each issue has its own action context and relational requirements, so concrete interpersonal edges may differentiate. The question is whether relational differentiation necessarily produces structural fragmentation in governance networks. This article focuses on an alternative form of integration: whether different issues still converge on a set of actors who receive relatively many nominations, and whether such positional structure persists over time. Here ethnicity, village boundaries, and local authority together shape who can form ties with whom, and they set the social backdrop against which network structure becomes readable.

Work on rural China has established that state institutions, project-based funding, and village social relations act in combination at the grassroots [1-5]. The state-local society perspective emphasizes in particular that formal organizations, local social networks, and resourceful actors are mutually embedded [6-11]. This perspective suits social spaces such as the study region, where administrative villages, cross-group

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interaction, and local authorities coexist. Yet existing studies fail to distinguish two levels of "integration": within a common actor boundary, they rarely compare overlap among concrete issue-specific ties, the alignment of actor positions across issues, and changes in these structures over time.

Local authority and multiple institutional foundations imply that the same actor may perform different social functions across governance issues. Village cadres, economic notables, and religious authorities provide contextual clues for interpreting positional structure. At the same time, digital platforms are increasingly incorporated into rural governance [12-14], but mediated ties still need to be understood within organizational and local relational contexts. This article treats digital collaboration as an extended relational layer, used to test the sensitivity of positional alignment to different definitions of relational scope.

Research in public administration and network governance has long maintained that multistakeholder collaboration must be understood beyond a single type of relation [15-18]. Social network analysis provides mature tools for comparing actors' structural positions across different relations [19,20]. In studies of environmental governance and public affairs, networks formed around different issues have been shown to produce distinct structural and governance consequences [21-25]. Multiplexity research asks whether the same edge carries multiple relational contents [26], whereas multilayer network research permits comparisons of actor rankings and core members across relational layers [27]. These approaches address different statistical objects: the former concerns directed edges, the latter concerns actor positions. This article translates this distinction into a theoretical problem for rural governance research, asking whether, once issue relations have differentiated, cross-layer association remains confined to the concrete edge level or instead manifests as different relations pointing to similar actor positions.

This article therefore asks: in ethnic village spaces constituted by state organizations, local societies, and multiple authorities, how do governance networks maintain structural integration after the relational edges of different governance issues have differentiated? The core argument is that integration is not unidimensional. When different issues differentiate along concrete ties, a governance network can achieve integration at the positional level through the convergence of diverse issues on similar actor positions, and this positional structure can persist across time. Three directional expectations follow. H1: concrete edges across issue relations show limited reuse. H2: the in-degree rank orderings of actors across relational layers exceed the expectations of stratified null models. H3: while concrete edges are updated, actor positional rankings and core membership maintain cross-period persistence. The following sections present the theoretical framework and case setting, report evidence at the edge, positional, and temporal levels, and finally discuss the implications for rural governance research and state-society theory.

2. Theoretical Question and Analytic Framework

Grassroots governance networks comprise at least four levels. Relational content specifies the issue through which an actor reaches whom; relational edges record whether a concrete connection occurs; actor positions indicate who receives relatively many nominations in a given relational layer; and temporal change shows whether these edges and positions persist. This article interprets in-degree rank orderings as actors' relative nomination positions within each relational layer. Merging these levels into a single network prevents researchers from distinguishing repeated use of the same edge from different relations pointing to similar actors.

The core analytical objects are consolidated into three concepts. Relational-edge differentiation means that the concrete directed edges of different issues overlap only limitedly. Cross-layer positional alignment means that actor in-degree rank orderings in different relational layers within the same period are structurally associated. Positional persistence means that positional rankings or core membership remain relatively stable across adjacent periods. Edge Jaccard measures overlap among concrete edges; in-degree

Spearman correlation measures association among positional rankings; core-group Jaccard measures overlap among core members. Here "position" denotes an actor's relative nomination position within a relational network. When edge renewal and positional persistence occur together, this article describes the result as structural continuity.

The theoretical judgment rests on two connections. First, ethnic boundaries and local social classifications create unequal relational opportunities, pushing issue relations to differentiate according to their substantive content. Second, state organizations, local social networks, and multiple authorities are mutually embedded at the grassroots level, allowing different issues still to identify actors occupying similar positions [6,7,28,29]. When the actor roster and measurement boundaries remain stable, such positional structure may persist across periods. Relational-edge differentiation, positional alignment, and cross-period persistence thereby form a testable structural combination. How identity operates, how authority forms, and how coordination actually proceeds are left to subsequent mechanism research.

On this basis, the article proposes three independent directional hypotheses. H1: issue relations differentiate at the concrete-edge level, showing low edge multiplexity and low cross-layer edge Jaccard. H2: high-position actors across relational layers are aligned; cross-layer in-degree Spearman correlations exceed the predictions of a stratified null model that preserves edge margins, village group, ethnicity, and role composition. H3: while concrete edges are updated, positional rankings and core membership persist across time, as shown by cross-period positional Spearman correlations and core Jaccard coefficients that remain robust under threshold adjustments. The three hypotheses concern the edge level, the contemporaneous positional level, and the longitudinal positional level, respectively; support for one hypothesis does not automatically imply support for either of the others.

2.1. Differentiation of Issue-Specific Relations

Ethnic boundary theory treats ethnic identity as a form of social classification and as a relational boundary [28,29]. In rural governance settings, ethnic identity may intersect with administrative village boundaries, kinship, local norms, and issue-specific action contexts. Relational-edge reuse refers to a single actor-to-actor tie carrying multiple types of issues, which corresponds to what the literature terms relational multiplexity [26,30]. Social network research has long shown that relational content determines the types of resources accessible through a tie [31]. Rural Chinese relational structures have historically been characterized by the differential mode of association and by renqing networks [32,33], and strong ties continue to matter for resource mobilization [34]. Consultation, production assistance, public cooperation, major-decision influence, and dispute mediation place different demands on competence and authority, while private trust and digital collaboration constitute still different relational contents. Issue relations therefore have a basis for differentiation.

Relational differentiation is observed through the degree of edge reuse. If most directed edges appear in only one relation, if edge-set overlap between any two relations is limited, and if these patterns remain after excluding items with special nomination boundaries, the data support relational specificity. Sparse networks produce low overlap on their own, so the observed values need a sterner test: random benchmarks that hold edge counts, degree distributions, and cross-group structure fixed. Relational differentiation is therefore read through three measures at once, namely union-edge multiplicity, cross-layer Jaccard similarity, and permutation intervals.

2.2. Multiple Authorities and Positional Alignment

The state-local society tradition holds that formal organizations, local networks, and resourceful actors are entangled with one another at the grassroots [6,7]. Network research arrives at a parallel insight from a different direction: cohesion does not require the same tie to be repeated. Actors who never share an edge can still hold a group together by converging on the same high-position members [35], and a few brokers can bridge clusters

that would otherwise stay apart [36]. When multiple authorities coexist, one economic notable may receive nominations in both resource assistance and public cooperation, while one religious authority may simultaneously attract nominations in major-decision influence and dispute mediation. Different relations can converge on the same actor. Cross-layer in-degree correlations, cross-layer core overlap, and composite positional concentration are used to identify such positional sharing. Positional correlation and edge Jaccard address different statistical objects, so this article tests edge-level differentiation and positional-level alignment separately.

This article defines cross-layer positional alignment as a structure in which diverse issues share similarly high-position actors within the same period. Relational-edge reuse concerns whether the same edge carries multiple issue types; positional alignment concerns whether different relations identify similar actor orderings and shared cores. The two correspond to relational content and social position, respectively.

Integrative forms in rural governance networks can thus be distinguished into three types. Organizational integration derives from the extension of state bureaucracy and formal institutions into villages. Relational integration derives from the accumulation of multiple functions on the same edge in societies of acquaintances. Positional integration derives from the convergence of multiple issues on similar actor positions when diverse authorities coexist. These three forms are complementary and, under specific conditions, substitutable: when formal organizational coverage is limited and relational edges differentiate across issues, positional integration becomes the key mechanism for maintaining network wholeness. Positional integration arises through two mechanisms. First, scarcity of capacity and resources: the social resources needed for consultation, assistance, cooperation, decision influence, and mediation are concentrated in a few actors, so nominations from different issues flow naturally to the same positions. Second, institutionalization of authority cognition: villagers share relatively stable social classifications of "who is effective" [11]. The coexistence of multiple authorities allows such classifications to cut across issue domains, and the value of a position ultimately derives from the resources accessible through it [37]. Both mechanisms imply that positional alignment does not depend on repeated concrete edges and can therefore coexist with edge differentiation over the long term. This article tests whether positional integration exists and identifies its conditions; substitution dynamics among the three integrative forms require cross-group comparative analysis.

2.3. Positional Persistence

Longitudinal change includes turnover in concrete relational edges and changes in actor positional rankings. Longitudinal network studies show that continuous edge turnover can occur simultaneously with relative stability in actors' structural positions [38]. Formal organizations and local social relations adjust across issues and over time [6,7], but rates of change may differ across levels. Cross-period edge overlap reflects whether concrete nominations are repeated; positional ranking and core group overlap reflect whether high-position actors persist. Low edge overlap alongside high positional overlap indicates that concrete nominations and positional orderings follow different temporal rhythms. This article uses this contrast to observe structural continuity.

Positional persistence describes the stability of actor rankings and core membership within a fixed roster across periods. High cross-period overlap in shared cores indicates some continuity in the positional structure embedded in nomination records. This article identifies structural continuity using cross-period indicators within the fixed roster. Because the major-decision-influence item has a special nomination boundary, stochastic actor-oriented models are not used to estimate edge-level dynamics [38]. Adjustments in relations, recall differences, survey context, and changes in local authority require process-oriented analysis.

3. Analytical Setting and Research Design

3.1. Setting: Six Ethnic Village Groups (A–F)

Fieldwork was conducted consecutively in 2022, 2023, and 2024 across six village groups (A–F) in an ethnic region of Southwest China. The study region combines highland valley and settlement spaces with the historical and cultural contexts of multi-ethnic societies. Administrative village governance, production and business activities, tourism services, and life around monasteries constitute multiple relational settings. In 2023, one respondent from Group C said, "During ethnic festivals, public activities, and dispute mediation, temples, village cadres, and villagers emphasize consultation and cooperation." Ethnographic research shows that in China's southwest ethnic regions, ethnic boundaries interact with local social organization and regional mobility to form the relational environment [39]; the revival of Buddhism and monastery networks constitutes an important source of local social integration [40]; and state development projects continually reshape local landscapes and relational configurations [41]. Village-level network studies also suggest that the village context systematically shapes relational structures [42]. The six village groups organize social space around natural settlements, and this article labels them, following survey categories, the Group A, Group B, Group C, Group D, Group E, and Group F. The six groups occupy different social spaces but maintain real intergroup contact, making them appropriate for comparing within-group and cross-group connections.

The six-group roster records three overlapping role categories: village cadres, economic notables, and religious authorities. These categories reflect respondents' public identities or the survey classifications of the researchers. Counted under overlapping labels, there are 25 village cadres, 39 economic notables, and 11 religious authorities, and 12 actors hold at least two roles. Under the primary-identity definition, there are 22 village cadres, 30 economic notables, and 11 religious authorities. Religious authority is retained as a role category in order to examine nominated positions across relational layers. Table 1 reports the size, ethnic composition, and role composition of the six-group roster. Aba matters analytically because it supplies stable actor boundaries while keeping several relational sources in play at once: village group, ethnic category, social role, and cross-group contact.

Table 1. Survey Sites and Roster Composition.

Village group	Roster size	Tibetan	Qiang	Han	Hui	Village cadres	Economic notables	Religious authorities
Group B	39	24	7	8	0	7	5	2
Group C	50	29	15	5	1	3	7	2
Group D	38	24	8	5	1	2	6	0
Group A	57	41	10	6	0	4	10	2
Group F	44	30	4	9	1	5	6	3
Group E	42	29	5	7	1	4	5	2
Total	270	177	49	40	4	25	39	11

Note: Figures cover the 270-actor roster. Roles overlap, and 12 actors hold more than one. The remaining members are ordinary villagers.

3.2. Fixed Roster, Nomination Rules, and Measurement

The first wave set a 270-actor roster in proportion to village cadres, economic notables, religious authorities, and ordinary villagers, drawing 38, 50, 39, 44, 57, and 42 actors from the six groups. Waves 2 and 3 kept the same roster and the same anonymous codes. Those initial proportions governed only how the roster was built; they placed no limit on whom a respondent could name. Respondents named contacts freely, and the team matched each name and stated role to the common six-group roster, with no village or identity quota. Every item asked for between one and six of the most frequent or most important contacts. Consent was secured before each wave began. Because the roster stays fixed, positions can be compared across waves, and the several relational sources (village group, ethnic category, social role, cross-group contact) remain visible throughout.

After cleaning, the file holds 270 actors, 810 panel records, and twenty-one 270 x 270 matrices. The original long file ran to 11,469 rows, in which 135 duplicated nomination groups left 137 redundant records. In the binary matrices, a repeated nomination of the same target by the same respondent in the same wave and item counts once. Every nominee sits on the fixed roster, and nobody nominated themselves. The files confirm that coding is complete across all three waves. Across layers, mean out-degree ranges from 1.46 to 2.63, well below the six-nomination ceiling per item, so the ceiling does not truncate density comparisons across layers.

The fieldwork records do not fully document the exact months of the three waves, the procedures used for missingness and replacement, proxy responses, roster maintenance, or follow-up protocols. The unit of analysis is therefore the three waves of coded data for the fixed roster. These data suit comparisons of relational edges, actor positions, and temporal change, but do not support broader inference about fieldwork procedures or population parameters.

Seven items measure distinct relations within the same actor boundary. Consultation, production assistance, public cooperation, major-decision influence, and dispute mediation form the main public-affairs analyses. Private trust and digital collaboration are used as extended analyses of the foundation of social relations and of mediated ties, respectively. Digital collaboration records issue ties carried by digital media; it does not measure digital governance capacity and is not used as an explanatory variable. Auxiliary analyses show that digital-collaboration out-degree correlates only weakly with scores on the digital literacy and digital governance participation scales and is closer to a relatively independent tie-behavior indicator. Accordingly, this article treats it as an extended relational layer. The major-decision-influence item excludes village cadres, whereas the remaining items have no such constraint. The article therefore treats that item's nomination boundary separately and reports results both after dropping the item and after excluding village-cadre nominees in the appendix (As shown in Table 2).

Table 2. The Seven Nomination Items and Their Analytic Levels.

Item	Wording of the nomination question	Analytic status
Consultation on important affairs	With whom do respondents most often discuss matters when they are unclear about important village affairs or wish to make suggestions?	Public-affairs relation
Production assistance	Which key people assist respondents in developing production or business activities?	Public-affairs relation
Public-task cooperation	With whom does a respondent cooperate most often and most smoothly in completing village public tasks?	Public-affairs relation
Major-decision influence	Apart from village cadres, whose opinions are important for major public decisions?	Public-affairs relation, special nomination boundary
Dispute mediation	Whom do respondents usually ask to mediate serious disputes?	Public-affairs relation
Private trust	Whom do respondents trust most and consult about important personal or family matters?	Foundation of social relations
Digital collaboration	When using WeChat, mobile phones, or apps for village affairs, services, negotiation, or information, whom do respondents contact most often?	Mediated issue ties, extended relational layer

3.3. Analytic Strategy

The seven nomination items were converted into three-wave binary directed matrices. For relation layers a and b , edge Jaccard is defined as $J(E_a, E_b) = |E_a \cap E_b| / |E_a \cup E_b|$, where a directed tie comprises sender, nominee, and direction. In-degree is the number of nominations an actor receives in a given layer; in-degree Spearman correlations compare actor rankings across layers. Core-group Jaccard coefficients compare overlap among the top k actors. Composite positions are computed as the equal-weighted share of nominations received across layers; the appendix also compares raw in-degree totals and equal weighting of five-layer shares.

The analysis proceeds in three steps defined by object of evidence. First, within- and cross-group edge proportions and densities describe the shared relational space. Second, union-edge multiplicity, cross-layer edge Jaccard, and permutation benchmarks identify relational-edge differentiation. Third, cross-layer in-degree correlations, core membership, stratified target permutations, and longitudinal indicators identify positional alignment and positional persistence. The three steps correspond to relational edges, actor positions, and temporal change.

Random benchmarks for edge overlap come from 1,000 within-group node permutations per wave. These permutations preserve layer-specific edge counts, sender out-degree, target in-degree distributions, and cross-group mixing structure, but break the mapping from specific actors to degree values. Positional correlation uses an additional null model with 1,000 stratified target permutations per wave. Target labels are reassigned within strata defined by identical village-group, ethnic, and role composition. This procedure preserves layer-specific edge counts, sender out-degree, and in-degree distributions while disrupting the correspondence of high-in-degree actors across relational layers. An observed correlation exceeding the permutation distribution indicates ranking alignment beyond what these marginal conditions generate. Because the two procedures address different layers, the edge-level and positional-level permutation models should not be conflated.

4. Differentiation of Issue Relations

To examine relational-edge differentiation, the analysis first describes whether the six groups constitute a shared relational space that permits cross-group nominations, and then compares edge overlap across relational layers. This distinguishes opportunity structures generated by village boundaries from differentiation generated by issue-specific questions.

4.1. Cross-Group Interaction and Village Boundaries

The six groups constitute a shared relational space that crosses village-group boundaries. Among roster-fixed actors, 95.9% to 97.8% received at least one nomination. Union edge counts across the seven layers range from 3,149 to 3,227, and cross-group edges account for about 75% of edges; respondents frequently selected actors from other groups. Because cross-group nodes naturally have more potential targets, density provides a stricter criterion. Within-group union density (6.32% to 6.58%) exceeded cross-group density (3.94% to 4.01%) in every wave, a gap of about 2.4 to 2.6 percentage points. The six groups thus display both cross-group interaction and a preference for within-group ties. The analysis therefore treats the six groups as a common relational space permitting cross-group nominations while retaining the distinction between within-group and cross-group ties. All issue relations are developed within this common roster (Figure 1).

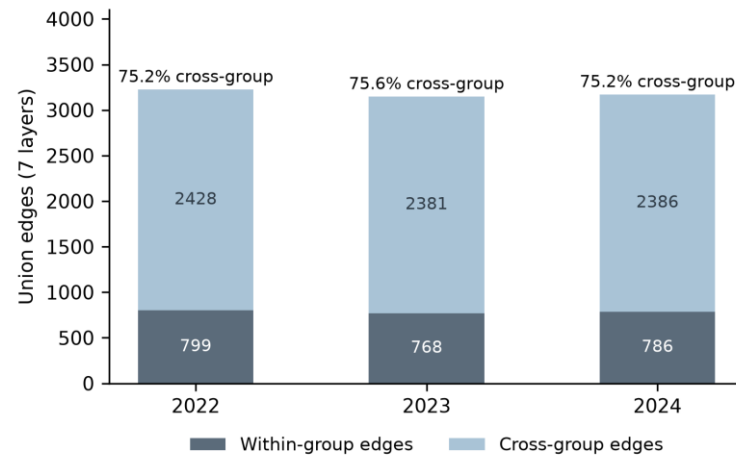


Figure 1. Within-group and Cross-Group Edges Across the Three Waves.

4.2. Limited Reuse of Concrete Edges

Concrete edges across the five public-affairs relations largely do not overlap. Across the three waves, 82.6% to 85.7% of union edges are unique to a single relation. The mean seven-layer cross-layer edge Jaccard ranges from 0.0283 to 0.0366, and the mean for the five public-affairs layers from 0.0337 to 0.0441. After removing the special-boundary major-decision item, cross-layer edge Jaccard still ranges only from 0.026 to 0.035. Issue relations therefore maintain distinct concrete connection boundaries. Permutation results show that the observed low edge overlap is not merely a product of network sparsity and cross-group structure: random means range from 0.0046 to 0.0049, and observed values exceed the 95% random intervals. Limited reuse beyond random expectation therefore coexists with relational-edge differentiation (As shown in Table 3).

Table 3. Edge Overlap Across Relational Layers

Indicator	2022	2023	2024
Single-relation edges as share of union edges	85.7%	85.0%	82.6%
Mean seven-layer edge Jaccard	0.0283	0.0323	0.0366
Mean permuted random value	0.0046	0.0047	0.0049
Mean cross-layer edge Jaccard, five public-affairs layers	0.0337	0.0373	0.0441
Mean seven-layer in-degree Spearman	0.499	0.448	0.453
Mean five-layer public-affairs in-degree Spearman	0.539	0.476	0.507

4.3. Variation in Issue-Specific Concentration

Relational layers differ in in-degree concentration (Figure 2). The in-degree Gini coefficients for major-decision influence and dispute mediation approach 0.90, indicating that nominations concentrate on a few actors. For private trust, Gini ranges from 0.423 to 0.452, indicating greater dispersion. Information consultation, production assistance, public cooperation, and digital collaboration fall in between. Such differences indicate that the items correspond to distinct relational contents. Digital-collaboration edges fluctuate across waves, at 672, 645, and 711, and the distribution of high-position digital collaborators resembles that of information, resource, and public-cooperation relations. Digital collaboration is therefore treated as an extended relational layer for testing the sensitivity of positional association to relational scope. Overall, relational-edge differentiation and limited edge reuse coexist: consultation, production assistance, and public cooperation draw on different substantive contacts, whereas decision influence and mediation concentrate nominations on fewer high-in-degree actors. The next section asks whether different issues nevertheless share similar pivotal actors.

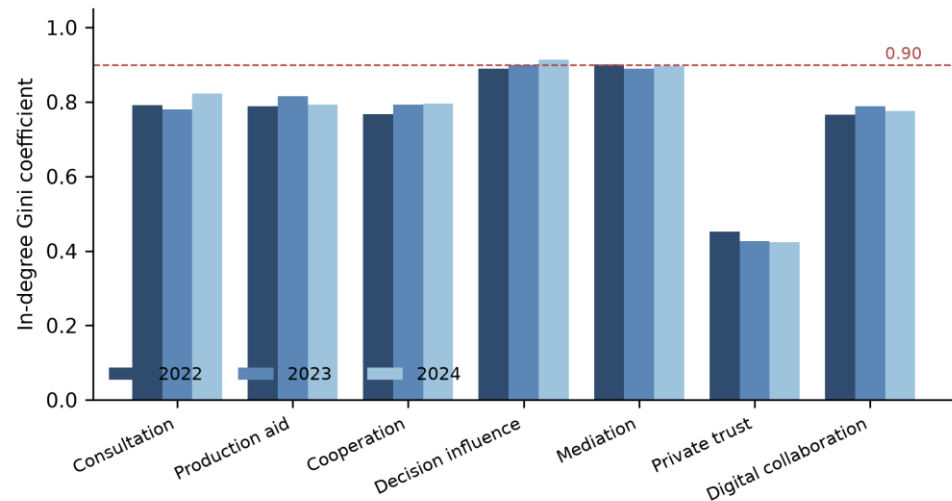


Figure 2. In-degree Concentration by Relational Layer and Wave.

5. Positional Alignment among Differentiated Relations

Relational-edge differentiation and positional alignment are structural phenomena at different levels. This section reports, in sequence, cross-layer positional correlation, the results of stratified target permutations, and the cross-period persistence of positional structure.

5.1. Coexistence of Edge Differentiation and Positional Alignment

Concrete edge differentiation and positional alignment coexist. For the five public-affairs relations, mean in-degree Spearman correlations are 0.539, 0.476, and 0.507 across the three waves; the seven-layer extended measure averages 0.499, 0.448, and 0.453. In each wave, 15 to 16 actors enter the top-10 in at least two relational dimensions, and 9 or 10 enter the top-10 in at least four dimensions. Nominators can select different targets, yet different issues still converge on similar actor positions. Low edge overlap and moderate positional correlation therefore occur together. Edge Jaccard measures whether a directed edge is reused, whereas in-degree Spearman measures rank association across relational layers. Read side by side, the two measures describe positional alignment inside a differentiated field of relations.

5.2. Positional Alignment Beyond Stratified Benchmarks

Table 4 gives permutation results for the five public-affairs layers and the seven-layer extension, while Table A5 lists in-degree correlations for all ten layer pairs. Observed means for the five public-affairs relations are 0.539, 0.476, and 0.507. Permutation means fall to 0.303, 0.283, and 0.306, with 95% intervals of 0.276-0.331, 0.257-0.312, and 0.281-0.334; in each wave the empirical upper-tail probability is 0.001. The seven-layer values (0.499, 0.448, 0.453) likewise sit above their permutation intervals. Figure 3 plots the pattern across all layer pairs. Alignment is uneven from one group to the next (Table A4), but these within-group figures describe local variation and do not support inference about a wider population.

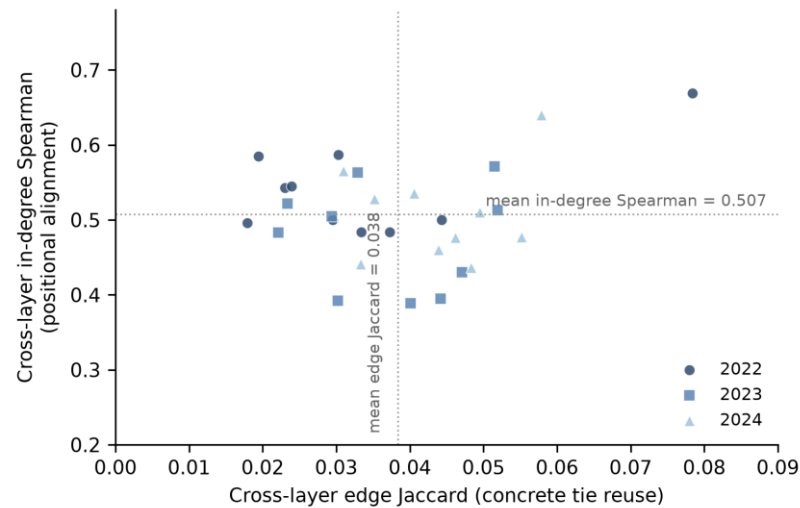


Figure 3. Edge Jaccard and In-Degree Spearman Correlations for All Layer Pairs.

Table 4. Permutation Tests for Positional Correlation.

Indicator	2022	2023	2024
Observed mean, five public-affairs layers	0.539	0.476	0.507
Permutation mean (95% interval)	0.303 (0.276-0.331)	0.283 (0.257-0.312)	0.306 (0.281-0.334)
Empirical upper-tail probability	0.001	0.001	0.001
Observed mean, seven layers	0.499	0.448	0.453
Permutation mean (95% interval), seven layers	0.262 (0.244-0.283)	0.257 (0.239-0.276)	0.277 (0.260-0.297)
Empirical upper-tail probability, seven layers	0.001	0.001	0.001

Note: Permutations hold layer-specific edge counts, each sender's out-degree, layer-specific in-degree distributions, and composition by village group, ethnicity, and role. The empirical upper-tail probability is $(1 + \text{the number of permuted values at or above the observed value})$ divided by 1001. Five-layer results form the main analysis; seven-layer results extend it.

Actor-level bootstrap results point the same way. The 95% node-bootstrap intervals for five-layer positional correlation are 0.469-0.603 (2022), 0.397-0.547 (2023), and 0.432-0.579 (2024). They describe actor-level uncertainty, not sampling confidence intervals for the six-group population. Weighting in-degree by monthly contact frequency barely moves the five-layer correlations (0.539, 0.475, 0.506), so positional alignment does not hinge on how ties are dichotomized.

5.3. Role Composition of Shared Cores

Several role categories share the core. In each year, the top-20 actors by composite position include village cadres, economic notables, and religious authorities, and some carry two recorded identities at once. Every role category clears its roster base rate, so the core concentrates by role while cutting across identity types. The three categories do not sit equally high in every relation: cadres and economic notables cluster in consultation, production assistance, public cooperation, and digital collaboration, whereas religious authorities are named mainly for major-decision influence and dispute mediation. Roles therefore cluster at the top without collapsing into one identity. A respondent from the Group F captured the point in 2022: "Although there are more online channels now, when important decisions are made, attention still mostly goes to village cadres and people with prestige." (As shown in Table 5).

Table 5. Role Distribution of Core Members.

Role	Roster count	Roster share	Top-20 count	Top-20 share	Concentration ratio	Hypergeometric p
Village cadre	25	9.3%	11	55.0%	5.94	<0.001
Religious authority	11	4.1%	4	20.0%	4.91	0.005
Economic notable	39	14.4%	13	65.0%	4.50	<0.001
At least two roles	12	4.4%	8	40.0%	9.00	<0.001

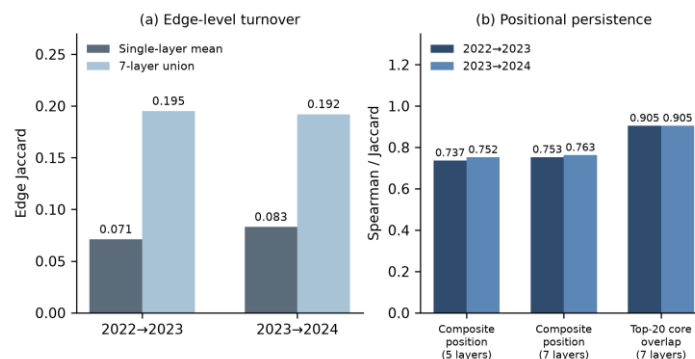
Note: Hypergeometric p-values compare observed counts with random draws from the roster composition. They describe the roster and do not estimate independent role effects or population representativeness.

The core concentrates by role, and it does not draw on a single identity type.

5.4. Cross-Period Persistence of Positional Structure

Adjacent waves move at two speeds. Edge Jaccard for individual relations stays below 0.12, and the seven-layer union sits near 0.19, so particular nominations repeat only in part. Composite positional rankings, by contrast, hold steady: Spearman correlations reach 0.753 and 0.763 across seven layers and 0.737 and 0.752 across the five public-affairs layers, while top-20 core overlap runs from 0.739 to 0.905. Rankings are stable, yet the exact edge of the core shifts with relational scope. Edge renewal therefore does not rewrite positional order. Nominees change with issue and wave, but nominations keep flowing to similar actors. Overlap thins at the top 10 relative to the top 20, which hints that the narrowest tier is the most fluid. Once village-cadre nominees are excluded, top-30 overlap drops sharply, so persistence is best read against overall rankings and the specific thresholds reported here.

The evidence supports all three hypotheses. H1: concrete edges separate by issue, with cross-layer Jaccard of only 0.034-0.044 that still clears the random benchmarks, so edges both divide and partially converge. H2: mean cross-layer in-degree Spearman correlations run from 0.476 to 0.539, above every 95% permutation interval, so high-position actors align across layers beyond what marginal structure would deliver. H3: across adjacent waves, composite positional Spearman correlations reach 0.737-0.763 and top-20 core Jaccard reaches 0.739-0.905, so positions persist while edges churn. Taken together, the three patterns make up what this article calls structural continuity: edges may differentiate and turn over, while the positional structure of the network holds (Figure 4).

**Figure 4.** Edge Turnover and Positional Persistence between Adjacent Waves.

6. Discussion and Conclusion

The findings add up to a single structural configuration. Across the six village groups (A–F), issue relations diverge at the edge level, actor positions align well beyond the

stratified permutation benchmark, and composite rankings carry over from one period to the next. Cross-layer association can therefore manifest either as reuse of particular edges or as different issues pointing to similar actor positions. Regional setting, ethnicity, and the coexistence of multiple authorities constitute the analytical conditions for this configuration.

This article distinguishes reuse of relational edges from cross-layer positional alignment. Edge reuse asks whether the same edge carries multiple issue types; positional alignment asks whether high-position actors across relational layers are structurally associated; positional persistence asks whether those rankings and core members are maintained over time. The results show that, within a fixed roster and its nomination boundaries, issue relations can maintain concrete boundaries while still forming structural connections through similar actor positions. This moves the conceptualization of network integration from relational content to the level of social position.

This finding adds to accounts that understand network integration through relational reuse or through the integration of formal agents. In the multiplexity literature, integration is usually equated with the accumulation of multiple relations on the same edge [26]. This study shows that even when edges in different layers almost never overlap, integration may still occur at the level of actor positions. Ethnic boundary theory and state-local society theory explain why grassroots networks draw on multiple relational sources: formal organizations, local authorities, and resourceful actors may be jointly recognized across different issues [6,7,28,29]. In Asian rural settings, state organizations and local societies are not two isolated relational systems. Different issues can differentiate along concrete edges while actors remain connected through shared positions. Relational content, actor position, and temporal change therefore require separate measurement.

Extending the comparison to Asian rural societies, these findings also speak to a broader governance experience. In the patron-client tradition of Southeast Asia, ties between villagers and local elites also span multiple issue domains, but integration in patron-client relations depends heavily on concrete personal bonds [43]. Recent research on rural local governance in South Asia points in a related direction: village-level institutions mediate state provision in ways that depend on local organizational capacity [44]; in Thailand, structural and cognitive social capital shape who takes part in rule-making across levels of irrigation governance [45]. In both cases, villagers reach governance through intermediate actors and stable relational positions rather than through direct state-citizen ties. The six village groups A–F reveal another possibility: when state organizations, economic notables, and religious authorities coexist, concrete ties may remain specific and differentiated while governance networks still maintain integration through convergent positional orientations. The comparison suggests that forms of integration in Asian village governance may shift systematically with the depth of state presence: the deeper state organization reaches into village society, the more integration may become positional rather than edge-based. This proposition awaits evaluation through further comparative research across Asian villages.

Three conditions hold this configuration in place. First, the nomination items must separate issue content. Second, the roster and nomination boundaries must allow comparison across waves. Third, the relational space must offer cross-group openings alongside a preference for within-group ties. On regional relevance, the six groups belong to a recognizable type of Southwest China village: multi-ethnic highland settlements where state administration, economic notables, and religious authority share one territorial space while tourism reworks livelihoods and contact. Villages scattered across western Southwest China, southern Gansu, and Qinghai share these conditions. The claim is therefore one of type, not statistical representation. These six groups are theoretically selected cases rather than a random sample. Where state organizations are present, economic notables are emerging, and religious authority persists, the pairing of edge differentiation with positional alignment should reappear. Testing that generalization requires comparison with villages in other ethnic regions.

For governance analysis, the article offers a way to read network structure. Analysts can keep issue-specific channels in view while asking which actors sit high across several layers, then trace tie burden, substitutability, and the concentration of rights and duties. In villages where relations come from many sources, separating edges from positions sharpens the diagnosis. One respondent from Group D put the intuition plainly in 2022: "Formerly many affairs had to be passed along layer by layer; now group notifications are faster, making cooperation among villagers, cadres, and monastery representatives easier." The processes of information referral, responsibility linkage, coordination efficiency, and task completion nevertheless require analysis of process data.

Four limitations should be noted. First, the 270-actor roster was configured by identity proportions; conclusions are limited to relational structure within the fixed roster and cannot be extrapolated to population parameters for the study region or other ethnic regions. Second, records of fieldwork procedures are incomplete, so the three waves of coded data cannot fully recover the tracking process. Third, nominations may reflect changes in relations, recall differences, and survey context. Because the major-decision item has a special nomination boundary, the outer core is sensitive to boundary adjustments and should be interpreted accordingly. Fourth, this study also collected attitudinal data on digital literacy, digital governance participation, and perceptions of governance change, but these are not incorporated into the present structural analysis; processes of ethnic-boundary negotiation, the operation of monastic organizations, and everyday coordination require additional process data. The article therefore treats territorial and ethnic characteristics as the analytical setting, network indicators as structural evidence, and identity effects, authority formation, and governance outcomes as topics for subsequent research.

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Appendix: Sensitivity Analyses

Table A1. Sensitivity to indicator definitions.

Specification	2022 edge Jaccard	2022 positional correlation	2023 edge Jaccard	2023 positional correlation	2024 edge Jaccard	2024 positional correlation
All seven layers	0.028	0.499	0.032	0.448	0.037	0.453
Without major- decision influence layer	0.026	0.473	0.031	0.426	0.035	0.433
Public-affairs five layers	0.034	0.539	0.037	0.476	0.044	0.507
All seven layers, village-cadre nominees excluded	0.016	0.445	0.015	0.392	0.017	0.385

Note: Positional correlation is the mean cross-layer in-degree Spearman. Across all four specifications, edge overlap is low while positional correlation exceeds edge overlap.

Table A2. Cross-period overlap of core members.

Specification	Wave transition	Top 5	Top 10	Top 20	Top 30
All seven layers	2022-2023	0.667	0.818	0.905	0.875
All seven layers	2023-2024	0.667	0.818	0.905	0.935

All seven layers, village-cadre nominees excluded	2022-2023	0.667	0.818	0.739	0.429
All seven layers, village-cadre nominees excluded	2023-2024	0.667	0.818	0.739	0.500

Note: Core group overlap is measured by Jaccard. After uniform nomination boundaries are imposed, overlap remains high among the top 20 but declines markedly among the top 30.

Table A3. Sensitivity of the composite-position definition.

Specification	Transition	2022-2023 Spearman	2023-2024 Spearman	2022-2023 top-20 Jaccard	2023-2024 top-20 Jaccard
Sum of raw in-degrees, five public-affairs layers	Both waves	0.738	0.748	0.739	0.905
Equal-weighted within-layer shares, five public-affairs layers	Both waves	0.737	0.752	0.739	0.905
Equal-weighted shares across seven layers (primary analysis)	Both waves	0.753	0.763	0.905	0.905

Note: All three definitions use the same 270 roster-fixed actors and the same adjacent-wave comparison. Directional rank correlations are consistent, whereas top-20 overlap varies by definition. The main text therefore reports definitional sensitivity and does not treat 0.905 as a unique constant.

Table A4. Positional correlation by village group.

Village group	2022	2023	2024
Group B	0.508 (0.369-0.708)	0.347 (0.093-0.510)	0.510 (0.386-0.720)
Group D	0.124 (-0.085-0.384)	0.171 (-0.127-0.463)	0.102 (-0.100-0.368)
Group C	0.367 (0.006-0.580)	0.433 (0.260-0.604)	0.512 (0.375-0.576)
Group F	0.502 (0.352-0.650)	0.426 (0.297-0.615)	0.502 (0.368-0.596)
Group E	0.164 (-0.145-0.474)	0.222 (-0.090-0.536)	0.302 (-0.113-0.771)
Group A	0.512 (0.374-0.686)	0.494 (0.197-0.782)	0.358 (0.139-0.606)

Note: Values are mean cross-layer in-degree Spearman correlations within each group-induced network; parentheses give the minimum and maximum across the ten public-affairs layer pairs. They describe local variation, not population parameters.

Table A5. In-degree correlations between relation layers.

Layer pair	2022	2023	2024
Information-resources	0.484	0.389	0.476
Information-cooperation	0.500	0.513	0.477
Information-decision	0.587	0.505	0.510
Information-mediation	0.543	0.483	0.565
Resources-cooperation	0.484	0.395	0.436
Resources-decision	0.500	0.430	0.460
Resources-mediation	0.496	0.392	0.441
Cooperation-decision	0.585	0.563	0.535
Cooperation-mediation	0.545	0.522	0.528

Decision-mediation	0.669	0.571	0.640
Note: Table A5 lists all ten layer pairs for the five public-affairs relations. Layer pairs are not independent population tests; the 21 pairs for the seven-layer extension appear in the supplementary materials.			

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