

Appendix 1

Supplementary Material of Archetype Analysis on Rural Renewal in China

Table A1.1: Code book

Code	Description	
R	Resource system and resource units	
R1	Size	The sizes of rural construction land in the cases are categorized into two groups, with a sufficiently large size difference between the groups.
R11	Large	The sizes of rural construction land in this group are larger than 10 ha.
R12	Small	The sizes of rural construction land in this group are smaller than 10 ha.
R2	Location	The location conditions of rural construction land.
R21	Peri-urban areas	Rural construction land is reportedly situated at urban fringes.
R22	Good accessibility	Rural construction land is reportedly in proximity to transportation lines (e.g., main roads and highways) or transportation nodes (e.g., airports and train stations).
R23	Remote areas	Rural construction land is reportedly distant from urban areas.
R3	Quality	The quality of the rural construction land.
R31	Distinctive quality	The area is endowed with certain advantages, such as a unique landscape.
A	Actors	
A1	Type	The actors who participate in rural renewal apart from rural households.
A11	Government	
A12	Village leaders/elites	
A13	Enterprise	
A2	Size	The numbers of rural households involved in rural renewal in the cases are categorized into two groups, with a sufficiently large numerical difference between the groups.
A21	Large	The numbers of rural households in this group are greater than 100.
A22	Small	The numbers of rural households in this group are smaller than 100.
A3	Internal homogeneity or heterogeneity	

A31	Internal homogeneity	The actors share similar and compatible beliefs, interests and priorities in regard to rural renewal.
A32	Internal heterogeneity	The actors have divergent and incompatible beliefs, interests and priorities in regard to rural renewal.
A4	Leadership/ entrepreneurship	A member of a rural community who has entrepreneurial skills or is respected as a local leader.
A5	Social capital	Rural households have formed a reciprocal connection or cooperative relation and trust each other.
GS	Governance system	
GS1	Network structure	The relation among actors.
GS11	Vertical relation	A top-down hierarchical relation among actors.
GS12	Horizontal relation	Actors are formally independent of each other, without a single central authority.
GS2	Incentive mechanism	Operational rules motivate stakeholders to participate and drive rural renewal.
GS21	Direct economic incentive	The stakeholders who participate in rural renewal can gain a monetary reward and/or subsidy.
GS22	Long-term incentive	The stakeholders who participate in rural renewal can gain jobs, social security and/or other long-term benefits.
GS3	Control mechanism	Operational rules force stakeholders to compromise and enforce rural renewal.
GS31	Administrative control	The administrative commands from an external authority (i.e., the government) are adopted.
GS32	Community control	The agreed-upon monitoring and sanctioning capabilities in a rural community are adopted.
GS4	Information mechanism	Operational rules specify the channels of communication among actors and what information (e.g., planning, cost and benefit) must, may, or must not be shared.
GS41	Information transparency	Information is communicated and shared broadly.
GS42	Information asymmetry	Information channels are blocked, and informational advantages are created.
GS5	Provision mechanism	Operational rules specify the actor(s) who should cover the cost of rural renewal.
GS51	Government	
GS52	Village leaders/elites	
GS53	Enterprise	
GS54	Rural households	

GS6	Appropriation mechanism	Operational rules specify the actor(s) who can benefit from rural renewal apart from rural households.
GS61	Government	
GS62	Village leaders/village elites	
GS63	Enterprise	
GS7	Decision-making mechanism	Collective choice rules specify the actors involved in a decision-making process (scheme design, revenue appropriation and distribution, etc.) and manners in which decisions are made.
GS71	Eligibility	The set of actors who are eligible to participate in a decision-making process.
GS711	Limited participation	The eligibility of stakeholders to participate in decision-making is limited.
GS712	Inclusive participation	The eligibility of stakeholders to participate in decision-making is broad.
GS72	Centralization	Decision-making is driven in a hierarchical and top-down manner.
GS73	Decentralization	Decision-making is driven in a decentralized manner based on the majority or unanimity principle.
GS8	Coordination mechanism	Collective choice rules ensure that stakeholders can claim their own interests, negotiate equally with each other and ultimately reach a consensus.
I	Interactions	
II	Scheme design	The guidelines and general plan for rural renewal, such as the targets, scale, routes and arrangements, are determined and decided.
II1	Complexity	As rural renewal is a systematic process, different economic, social and ecological relations should be incorporated into the scheme design. If the scheme is not sufficiently rational and subsequently causes disputes, then the project will be difficult to implement, and the performance will suffer.
II11	High	The scheme should be compatible with the interests and demands of a large number of rural households and/or those of the ecological system involved in a large size of rural land, thus increasing the difficulty of rationalizing.

I112	Low	The scheme should be compatible with the interests and demands of a small number of rural households and those of the ecological system involved in a small size of rural land, thus reducing the difficulty of rationalizing.
I12	Uncertainty	The scheme design confronts the uncertainty originating from the cognitive limitations (e.g., bounded rationality and incomplete information) of decision-makers.
I121	High	The decision-makers have insufficient or even a lack of knowledge and experience regarding scheme design.
I122	Low	The decision-makers have sufficient local knowledge and relevant experience regarding scheme design.
I2	Implementation	The funds for rural renewal are assembled and the project scheme is enforced.
I21	Asset specificity	The asset occupied by rural renewal is unavailable to other alternative uses.
I211	High	Rural renewal reportedly requires a large amount of money and/or a long duration of investment.
I212	Low	Rural renewal reportedly requires an amount of money that is not very large and a duration of investment that is not very long.
I22	Site specificity	The implementation of the rural renewal depends on construction land with a specific location, meaning that if all the land in the project area is not accessed to enforce rural renewal, the former efforts of land assembly will be in vain. In addition, once a land owner resorts to hold-up, a developer who has assembled part of the land will suffer from a project delay.
I221	High	The large scale of the renewal requires the developer to assemble a large size of land and/or to reach agreements with a large number of rural households; thus, the hazard of hold-up arises.
I222	Low	Renewal that is not on a very large scale requires the developer to assemble a small size of land and to reach agreements with a small number of rural households; thus, the hazard of hold-up will be not as severe.

I3	Revenue appropriation and distribution		The revenue generated from rural renewal, such as the economic income from rural construction land consolidation and redevelopment, is appropriated and distributed among actors.
I31	Complexity		Various interest claims by different actors have to be dealt with, adjusted and coordinated.
I311	High		Interest claims from a large number of rural households remain to be settled.
I312	Low		Interest claims from a small number of rural households remain to be settled.
I32	Time horizon		The dimension of time that the decision-makers take into account when appropriating the revenue of rural renewal.
I321	Long-term time horizon		Decision-makers tend to prioritize long-term benefits.
I322	Short-term time horizon		Decision-makers focus on short-term benefits while disregarding long-term benefits.
O	Outcomes		
O1	Rural living environment		The extent to which rural renewal improves the housing and living conditions of a rural area.
O11	New residences with limitations		Modernized residences are built but fail to fit the context-specific conditions (e.g., living conventions) of a rural area.
O12	New and suitable residences		Modernized residences fit the context-specific conditions (e.g., living conventions) of a rural area.
O2	Rural income		The extent to which rural renewal increases income for a rural area.
O21	Significantly increased rural income		Rural households greatly benefit from rural renewal, which markedly improves rural wealth.
O3	Rural vitality		Whether rural renewal enables a rural area to gain the capability of continuously improving its well-being.
O31	Enhanced rural vitality		Rural renewal creates job opportunities and/or a reasonable development path (e.g., tourism) for a rural area.

The cases from group 1 (Unsustainable rural renewal) are taken as an example to illustrate how to extract archetypes and sub-archetypes based on the four criteria (see the section *Data analysis*). The equivalence classes of the cases determined by the FCA (formal concept analysis) are listed below (Table A1.2).

Table A1.2: Equivalence classes of the cases

No. of equivalence class	Attributes	Cases
1	A11, GS51, GS61, GS72, I121, I322, O11	3, 4, 12, 17, 18
2	R11, A11, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I322, O11	3, 4, 17, 18
3	A11, GS21, GS51, GS61, GS72, I121, I322, O11	3, 12, 17, 18
4	A11, A32, GS11, GS51, GS61, GS72, I121, I322, O11	3, 4, 12, 17
5	R11, R21, A11, A21, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I311, I322, O11	3, 4, 18
6	R11, A11, GS21, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I322, O11	3, 17, 18
7	R11, A11, A32, GS11, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I322, O11	3, 4, 17
8	A11, A32, GS11, GS21, GS51, GS61, GS72, I121, I322, O11	3, 12, 17
9	R11, R21, R22, A11, A21, GS21, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I311, I322, O11	3, 18
10	R11, R21, A11, A21, A32, GS11, GS42, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I311, I322, O11	3, 4
11	R11, A11, A32, GS11, GS21, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I322, O11	3, 17
12	A11, A32, GS11, GS21, GS31, GS51, GS61, GS72, I121, I322, O11	3, 12
13	A11, A22, A32, GS11, GS21, GS41, GS51, GS61, GS72, I121, I312, I322, O11	12, 17
14	R11, R21, R22, A11, A13, A21, GS12, GS21, GS51, GS53, GS54, GS61, GS63, GS711, GS72, I111, I121, I211, I221, I311, I322, O11	18
15	R11, R21, R22, A11, A21, A32, GS11, GS21, GS31, GS42, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I311, I322, O11	3
16	R11, R31, A11, A22, A32, GS11, GS21, GS32, GS41, GS51, GS54, GS61, GS711, GS72, I111, I121, I211, I221, I312, I322, O11	17
17	R12, A11, A22, A32, GS11, GS21, GS31, GS41, GS51, GS61, GS712, GS72, I112, I121, I212, I222, I312, I322, O11	12

R11, R12, R21, R22, R23, R31, A11, A12, A13, \emptyset
 A21, A22, A31, A32, A4, A5, GS11, GS12,
 GS21, GS22, GS31, GS32, GS41, GS42, GS51,
 GS52, GS53, GS54, GS61, GS62, GS63,
 GS711, GS712, GS72, GS73, GS8, I111, I112,
 I121, I122, I211, I212, I221, I222, I311, I312,
 I321, I322, O11

First of all, according to criterion 1, equivalence classes 14-18 are excluded since each of them covers less than two cases. The remaining 13 equivalence classes all meet criterion 2 because the causality between the diagnostic and design attributes and outcome presented by each class can be interpreted by the theory concerning the social-ecological systems (SES) analysis, e.g., new institutional economics. Further, according to criterion 3, equivalence class 1 qualifies as an archetype because it cannot be composed of any other classes. According to criterion 4, equivalence classes 2-4 qualify as sub-archetypes. Equivalence class 2 is composed of the identified archetype (class 1) with six additional attributes, i.e., R11, GS54, GS711, I111, I211 and I221. Equivalence class 3 is composed of the identified archetype (class 1) with one additional attribute, i.e., GS21. Equivalence class 4 is composed of the identified archetype (class 1) with two additional attributes, i.e., A32 and GS11.

However, equivalence classes 5-13 don't qualify as archetypes or sub-archetypes since they fail to meet criterion 3 or 4. Equivalence class 5 is a sub-archetype of sub-archetype since it is composed of the identified sub-archetype (class 2) with three additional attributes, i.e., R21, A21 and I311. Equivalence class 6 is composed of two identified sub-archetypes, i.e., classes 2 and 3. Equivalence class 7 is composed of two identified sub-archetypes, i.e., classes 2 and 4. Equivalence class 8 is composed of two identified sub-archetypes, i.e., classes 3 and 4. Equivalence class 9 is composed of two identified sub-archetypes (classes 2 and 3) with four additional attributes, i.e., R21, R22, A21 and I311. Equivalence class 10 is composed of two identified sub-archetypes (classes 2 and 4) with four additional attributes, i.e., R21, A21, GS42 and I311. Equivalence class 11 is composed of three identified sub-archetypes, i.e., classes 2, 3 and 4. Equivalence class 12 is composed of two identified sub-archetypes (classes 3 and 4) with one additional attribute GS31. Equivalence class 13 is composed of two identified sub-archetypes (classes 3 and 4) with three additional attributes A22, GS41 and I312.

Finally, one archetype (class 1) and three sub-archetypes (classes 2-4) are extracted from the cases in the group 1.