From Separation to Integration: The Construction Logic of the Historical Urban Area Physical Examination Evaluation System* — Based on System Coupling Theory

Zhang Yang, He Yi

Abstract: The physical examination and evaluation of historical urban areas covers the entire chain of "protection—renewal—control—construction—governance," which is a complex challenge. The key to addressing this issue lies in how the urban physical examination system and the historic city protection system can be procedurally integrated. Based on system coupling theory, this paper explores the construction logic of the historical urban area physical examination evaluation system through an analytical framework of "coupling process (institutional logic)—coupling model (institutional form)—coupling function (institutional goals)." At the institutional logic level, the focus should be on three scales: urban areas, blocks, and buildings. The existing urban physical examination indicators should be extended downward, and the requirements of the historic city protection system should be structurally embedded into the historical urban area physical examination evaluation framework. On this basis, the "historical block—surrounding community" should be fitted as the evaluation unit in practical terms, integrating both protected and non-protected buildings into a comprehensive package to ensure the completion of the physical examination and evaluation tasks. Moving from institutional logic to representational forms, it is further proposed that the existing urban physical examination evaluation system be continually improved through the horizontal linkage of scales such as "urban area—street" and "block—community." The corresponding institutional goals should also connect the urban renewal-oriented physical examination evaluation system with urban governance and the protection and inheritance work, providing theoretical insights to balance the practical dilemmas of protection and renewal.

Keywords: Historical urban areas; urban physical examination and evaluation; institutional construction; system coupling theory; refined governance; historical and cultural preservation and inheritance

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Urban physical examination is a fundamental task that involves comprehensively evaluating the status of urban development and construction in order to develop targeted measures, optimize urban development goals, address gaps in urban construction, and solve "urban diseases" [1]. In 2018, the Ministry of Housing and Urban-Rural Development, in collaboration with the Beijing municipal government, took the lead in launching the urban physical examination work and initially established this system. In 2021, the Ministry of Natural Resources issued the "National Spatial Planning Urban Physical Examination Evaluation Guidelines," further defining the institutional connotation of urban physical examination and evaluation. This work aims to leverage the collective efforts of local governments to promote high-quality urban development, meet the growing demand for better living environments, and provide a policy basis for decision-making processes that bridge the "last mile" of urban development and construction [2]. Currently, existing research has conducted constructive explorations on the urban physical examination evaluation system. For example, at the organizational and management level, relevant studies have established a work mechanism for urban physical examination and evaluation that includes multiple domains, interdisciplinary involvement, interdepartmental collaboration, and multi-stakeholder coordination (government-led, public participation, technical support from planning agencies and universities), as well as multi-objective visions (focusing on urban renewal, urban governance, and the protection and inheritance of historical and cultural heritage, etc.) [3-4]. These studies have proposed strategies to maximize the effectiveness of physical examinations, covering aspects such as clarifying examination tasks, constructing evaluation frameworks, optimizing indicator systems, deepening diagnostic methods, and strengthening feedback and communication. This has effectively provided a systematic, cross-departmental integrated evaluation tool [5]. The corresponding research conclusions have been applied to the implementation, management, monitoring, and feedback of urban physical examination evaluation. From the perspectives of work organization and outcome application, a preliminary system for the tasks of urban physical examination throughout its life cycle has been established. In different urban governance environments, the adaptability of the existing institutional framework of urban physical examination has been evaluated [6]. Through feedback optimization of implementation paths, these efforts have facilitated the updating and iteration of examination policies and evaluation frameworks, as well as the transformation of urban governance paradigms in the new era [7].

On March 18, 2024, the urban physical examination work was fully launched in 297 cities at or above the prefecture level across China. The physical examination and evaluation work, initially piloted in select cities, has gradually expanded, and the evaluation objects now cover the entire

scope and elements of urban space. It is noteworthy that historical urban areas, represented by historical built environments, have received insufficient attention in existing research. Historical urban areas refer to regions within historically and culturally significant cities that have a clear historical scope, well-preserved patterns and features, and require comprehensive protection and control. This includes areas typically referred to as ancient cities, old towns, and historic districts [8-9]. Since the establishment of the historic city system in 1982, there have been numerous unresolved issues regarding the protection, renewal, control, development, and governance of historical urban areas. The conflict between development and historical preservation has always existed and is becoming more intense [10]. Especially with urban expansion and spatial sprawl, historical urban areas are no longer an independent, complete spatial concept; they have been incorporated into broader, larger systems and have become an organic part of modern cities. Historical urban areas are mostly located in the central urban regions (i.e., the main city area), where population density is high, renovation needs are significant, and protection pressure is immense, making urban renewal tasks both heavy and challenging [11-12]. Therefore, the physical examination and evaluation of historical urban areas is both necessary and urgent, with significant practical implications. How to conduct a reasonable physical examination and evaluation of these complex, large-scale systems that encompass the entire chain of "protection—renewal—control—construction—governance" requires precise thinking and further research.

1 Construction Background of the Historical Urban Area Physical Examination and Evaluation System

1.1 Institutional Foundation

The large-scale urban renewal movements conducted in the 1960s and 1970s severely damaged the overall structure and appearance of historic cities, cutting off their historical and cultural connections [13]. To protect a number of historical cities from constructive destruction, China established the Historic and Cultural Cities Protection System in 1982. The system emphasizes the significance of delineating historical urban areas and implementing comprehensive protection, as outlined in the "Regulations for the Protection of Historic and Cultural Cities," the "Standards for the Protection Planning of Historic and Cultural Cities," and the "Regulations for the Protection of Historic and Cultural Cities, Towns, and Villages" [14]. As of May 2024, the Ministry of Housing and Urban-Rural Development has successively announced 143 historic and cultural cities.

In February 2011, the Ministry of Housing and Urban-Rural Development and the State Administration of Cultural Heritage launched a national inspection of the protection of historic and cultural cities. Through a systematic review of changes in the scope of protection, the number of protected objects, the development and implementation of protection plans, the formulation of local regulations, and the use of national special subsidies, they identified issues in the protection work of historic cities. Based on this, it was proposed that cities no longer meeting the criteria for national historic and cultural cities be recommended for inclusion on the endangered list or have their designation revoked by the State Council. This initiative aimed to summarize the experiences within the historic city protection system and marked the beginning of institutional exploration into the evaluation of historical urban areas.

Since 2017, the national and local urban physical examination and evaluation systems have also

begun to involve historic and cultural cities. Relevant policies have carried out historical and cultural resource surveys and evaluations, addressing aspects such as the system and mechanisms of historic city protection, financial investment, talent development, registration and filing, planning preparation and implementation, and monitoring management. For example, in December 2018, the Ministry of Housing and Urban-Rural Development and the State Administration of Cultural Heritage proposed that local governments take primary responsibility for the protection of historic and cultural cities, towns, and villages, establishing a "yearly physical examination, five-year evaluation" system to comprehensively assess the progress of historic city and district development. This system aims to balance the relationship between construction development, urban renewal, and preservation [15].In April 2019, the Fujian Provincial Department of Housing and Urban-Rural Development issued a notice on conducting evaluations and inspections of the protection of historic and cultural cities, districts, towns, and traditional villages. The evaluation subjects included eight historic and cultural cities and 20 historic and cultural districts in the province, and it conducted a census of the protection scope, changes in protected elements, and the preparation and implementation of protection plans for historical urban areas [16]. Subsequently, provinces such as Shandong, Jiangxi, Zhejiang, and municipalities such as Beijing began their own evaluation work for historic and cultural cities, focusing on identifying, publishing, and mapping historical and cultural resources.Against this backdrop, in November 2021, the Ministry of Housing and Urban-Rural Development and the State Administration of Cultural Heritage jointly issued a notice on strengthening the special evaluation work for national historic and cultural cities. The notice proposed that starting in 2022, each historic city should carry out a self-assessment every year, and every five years, the two departments would organize third-party agencies to conduct research and evaluations of all designated historic cities. This top-level system aims to guide the comprehensive and accurate assessment of historic city protection, ensuring the full coverage of spatial areas and all relevant elements, thereby improving protection responsibilities, capabilities, and standards. See Figure 1. In recent years, the national and provincial-level governments have made it clear that the protection and development of historic and cultural cities not only require policies such as norms, standards, and regulations, as well as the support of laws and regulations, but also need to reflect the effectiveness of protection and construction intensity through the institutional design of physical examination and evaluation. This will address issues at different stages and provide "full-process monitoring" for the current protection and development work, offering "tracking reports" and "targeted solutions." As the core protection area of historic and cultural cities, historical urban areas are the main focus of the physical examination and evaluation work. Based on the existing system, it is necessary to further clarify the construction logic and framework of the evaluation system and ensure the effective implementation of the physical examination and evaluation work.

1.2 Potential Issues

As a historically complete human settlement unit, the physical examination and evaluation of historical urban areas requires coupling the tasks from both the historic city protection system and the urban physical examination system. On one hand, it is necessary to utilize the technical approach and framework of urban physical examination to systematically investigate and accurately identify the long-standing "urban diseases" of historical urban areas, addressing them

one by one to improve the living environment and meet the daily needs of residents [17]. On the other hand, under the regulations of the historic and cultural city protection system, it is essential to precisely control the elements that need to be protected and inherited within the historical urban areas to reflect the effectiveness of the protection efforts. The integration of these two institutional systems can achieve a balance between "protection" and "renewal"—a long-standing practical contradiction, which may be partially addressed with the establishment of the historical urban area physical examination and evaluation system.

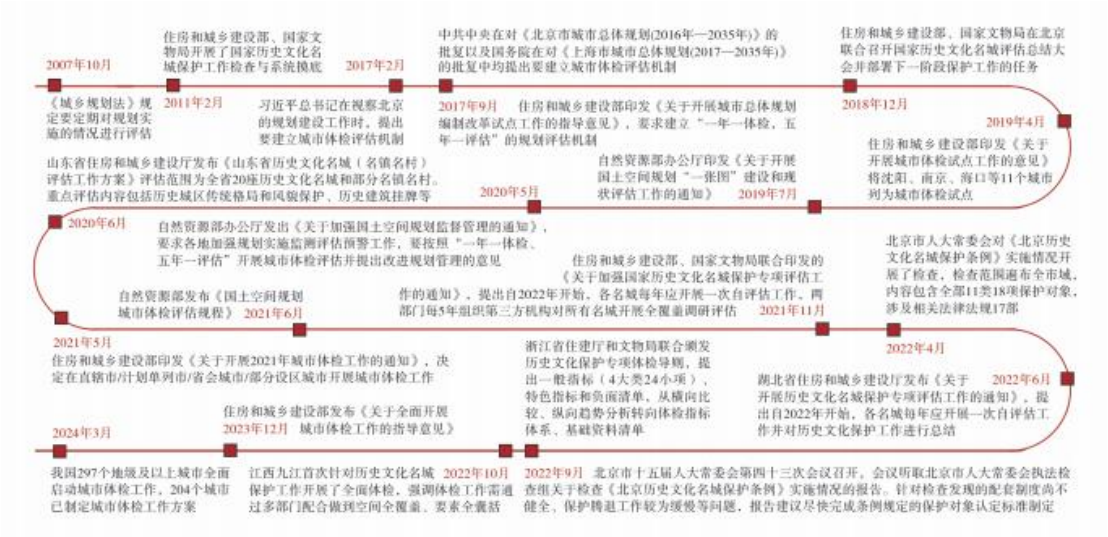

Figure 1: Institutional Foundation of Historical Urban Area Physical Examination and Evaluation

However, the reality is that the institutional foundation for the physical examination and evaluation of historic and cultural cities/historical urban areas remains within the "protection" context, which is not entirely compatible with the "renewal" goals of physical examination and evaluation. The related evaluation policy documents are also focused on analysis reports of the "protection" situation. It should be noted that over the past 40 years of historic city protection, apart from a few historical urban areas, such as Pingyao Ancient City and Lijiang Ancient City, which have been preserved as a whole, the rest of the historical urban areas have undergone varying degrees of transformation under the goal-oriented pressures of urban construction efficiency and speed. These areas have become "old cities" with ancient city contours, rather than pure "ancient cities" [18]. Beneath the rigid protection system, there are numerous complex, vague, and even chaotic elements of old city renewal that need to be examined and evaluated. Against this reality, the existing system for the physical examination and evaluation of historical urban areas has not addressed the essential issues of these areas within the evaluation procedures.

The root of this problem lies in the incompatibility between the historic city protection system and the urban physical examination system. The latter is situated within the hierarchical administrative units of "city—urban area—street," while the former is reflected in the historical and cultural units at the scale of "historical urban areas—districts—buildings." The leading departments and control scopes of these two systems are different, and their corresponding work objectives and technical approaches also vary. Even within the same physical examination

and evaluation system, many cities are required to carry out both the "urban physical examination" work led by the Ministry of Housing and Urban-Rural Development and the "urban physical examination evaluation" procedures driven by national spatial planning [19]. The simultaneous implementation of the same tasks by multiple agencies reduces the efficiency of the system and highlights the redundancy in the system design.

Considering that existing research has not truly addressed built spaces like historical urban areas, it is difficult to provide effective research data, perspectives, or support for the construction of a physical examination and evaluation system for historical urban areas. Currently, the urban physical examination evaluation system pays insufficient attention to historical urban areas, and the relevant institutional content is not specific enough. Therefore, it is very challenging to construct a comprehensive and accurate system for the physical examination and evaluation of historical urban areas in a single research effort. However, it is necessary and feasible to analyze and argue for the construction logic of this system. How to explore the compatibility of the physical examination and evaluation system for historical urban areas within the policy framework of urban physical examination evaluation requires prior theoretical thinking—using top-level design at the institutional level to promote the effective integration of multiple systems.

1.3 Theoretical Framework

System coupling theory originated in physics and is the theory that studies how the coupling relationships between two or more system elements, or within a system among its subsystems, are coordinated and feedbacked [20]. For example, the relationship between electricity and magnetism is a coupling relationship: when electricity changes, it inevitably leads to a change in the magnetic field. This theory was initially applied in natural sciences such as biology, geography, and agronomy, and was later introduced into human settlement science to analyze the phenomenon of systems influencing and joining together through interaction. It explores the development mechanisms and action mechanisms of positive interactions between systems [21-22].

In system coupling theory, "coupling" is essentially a process of deconstruction and reconstruction. Originally, two systems operate independently, but the systems are related in content and, under demand-driven conditions, can communicate with each other. This interaction and communication evolve into system integration. In this process, the system structure will be reorganized, system potential will extend, and the structural functions of different systems will combine to create new systems [23]. It is not merely an addition of "quantities" of the original systems, but an elevation into a new functional entity, a higher-level system architecture, thus gaining higher-dimensional functions, potential, opportunities, and unlocking the value that the two systems could not produce before coupling.

In this context, relevant research divides system coupling theory into three levels: coupling process, coupling model, and coupling function. The "coupling process" refers to the operational mechanism of system integration, reflecting the logical relationship of system coupling. The "coupling model" represents the manifestation of the system after integration, being the morphological representation of the coupling phenomenon. The "coupling function" is the result of system coupling, carrying the functional performance after integration. The interactions between these three elements form the coupling theoretical framework [24-25]. The research paradigm from coupling process to coupling model and then to coupling function allows for the

analysis of the construction path, presentation methods, and value orientation in a system integration, from the inside out.

The institutional construction logic of historical urban area physical examination and evaluation is centered on the integration of the two institutional systems: historic city protection and urban physical examination evaluation. Guided by system coupling theory, the research is conducted within the analytical framework of "coupling process → coupling model → coupling function" to clarify the logic, form, and goals of this institutional system (Figure 2). The study needs to explore three questions in sequence: first, how should the historic city protection system and the urban physical examination system couple in the historical urban area physical examination and evaluation system? Second, what are the morphological representations of the coupled institutional system? Finally, what is the goal orientation of this institutional form?

2 Historical Urban Area Physical Examination and Evaluation Institutional Logic

2.1 Urban Area Level: System Integration, Indicator Subordination, Structural Merging

Institutional logic refers to the specific practices that form the behavioral and organizational norms within a given field, reflecting the internal mechanisms of institutional construction and operation [26]. The institutional logic of historical urban area physical examination and evaluation needs to incorporate the normative requirements of the historic city protection system while also considering the general applicability of urban physical examination evaluation indicators.As the core of the historic city protection system, historical urban areas are subject to multiple regulations related to construction control and protection management. Relevant aspects include the number of immovable cultural heritage sites, the registration/renovation rates of historical buildings, the preservation integrity of historical (cultural) districts/historical sites/historical scenic areas, the maintenance ratio of ancient trees, the adaptability of industrial heritage for reuse, the proportion of digital information collection and mapping, the development and enforcement of management regulations/protection planning/technical standards, the establishment and execution of daily patrol management systems, and the conduct of self-assessment and third-party evaluation tasks. These need to be converted into quantitative indicators and integrated into the institutional procedures for historical urban area physical examination and evaluation. See Figure 3.

Additionally, the historic city system includes relevant requirements that can practically reflect the unique characteristics of historical urban areas, including but not limited to the integrity of historical spatial patterns, clarity of historical boundaries, continuity of landscape corridors, harmony of urban colors, and authenticity of the mountain-water environment. These should be packaged as a special feature for the landscape characteristics and structurally integrated into the framework of historical urban area physical examination and evaluation [27]. This evaluation focus can highlight the spatial characteristics of historical urban areas compared to modern cities, forming a precise set of evaluation indicators. Relevant evaluation indicators should be presented using a combination of qualitative and quantitative methods. For example, historical urban area color analysis based on deep learning and street view images can assess the color harmony of street facades; the balance of architectural space levels can be used to measure the skyline order in historical urban areas; and a perception and evaluation system for the historical urban area’s appearance can be constructed based on semantic analysis [28-29].

Based on the historic city protection system, it is also necessary to recognize that historical urban areas, as residential units within urban space, need to undertake regular top-down physical examinations and evaluations to reflect the aspects of the living environment that require updating and renovation [30]. Currently, both the Ministry of Natural Resources and the Ministry of Housing and Urban-Rural Development have issued corresponding policy documents to advance the physical examination and evaluation work. However, there is an overlap in the content between the two institutional systems. To address this, it is necessary to "merge similar items" from the 6 dimensions and 33 basic indicators of the Ministry of Natural Resources' "Urban Physical Examination and Evaluation" procedures, and the 8 sections and 65 basic indicators of the Ministry of Housing and Urban-Rural Development's "Urban Physical Examination" system, in order to avoid unnecessary work due to duplicate evaluations. Additionally, due to spatial differences at various scales, such as citywide, urban district, and urban area, as well as the heterogeneity of different types of urban spaces, not all physical examination and evaluation indicators are applicable to historical urban areas. Therefore, the merged regular physical examination and evaluation system needs to be compared for compatibility with the built environment of historical urban areas. Appropriate indicators should be selected for subordination and placed within the spatial scope of the historical urban area that is to be examined and evaluated. By structurally embedding the historic city protection indicator system and selectively subordinating the urban physical examination indicators, the compatibility of the existing physical examination and evaluation system can be achieved, moving from "separation" to "integration." This will promote institutional coupling at the historical urban area level and initially construct a targeted physical examination and evaluation indicator system, consisting of 6 levels and 70 secondary indicators. See Figure 4.

2.2 Block Level: Boundary Opening, Spatial Integration, Unit Reorganization

From the historical urban area, we further explore the mesoscopic dimension of historical (cultural) districts, historical sites, and historical scenic area preservation zones. The physical examination and evaluation at this level need to inherit the tasks delegated from the urban area level, such as: at the block level, assessing the preservation status of spatial patterns, textures, scale, and street-facing facades; at the population and industrial economic levels, analyzing current issues such as population density, business vitality, and innovation industries in the district. At the same time, it is important to recognize that although historical districts have clearly defined protection areas and relevant protection plans, which demarcate specific boundaries, they are not "cultural islands" and their boundaries with surrounding communities are not always clearly defined [31]. On the contrary, due to the high-density living environment pressure, as well as the restrictions of the protection system on updates, renovations, and construction, the service facilities within historical districts are insufficient to meet the residents' needs, and there is a relative lack of public spaces for social interactions.

Given these realities, many residents of historical districts have formed close connections with surrounding communities, creating a shared "block-community" unit, functioning as a whole in terms of social interaction, neighborhood watch, and resource sharing. The "block-community" unit essentially goes beyond the historical district protection range defined by the historic city protection system and is not simply a "community" under the "street" administrative division. Instead, it forms a new, higher-level, functionally integrated structure resulting from the fusion of

the two [Figure 5(a)]. For physical examination and evaluation at the historical district level, a new perspective on the spatial reorganization of blocks and communities is required. The evaluation model should break away from treating historical districts as independent from surrounding communities and assess them as an integrated whole. For example, when evaluating the public service facilities in historical districts, it is necessary to analyze how surrounding communities contribute to healthcare, administrative management, and social welfare facilities, and their influence on the historical district [32], conducting the evaluation within this new spatial unit. Additionally, the evaluation of historical districts should extend to surrounding communities in aspects such as cultural display and commercial services, forming an integrated evaluation model with regional linkage.

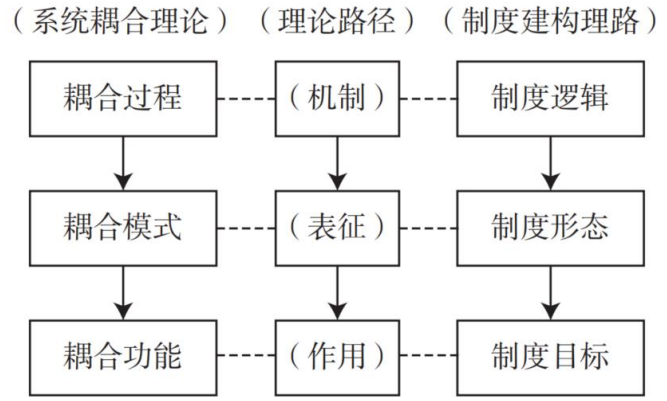

Fig.2 Theoretical framework for assessing historic urban areas

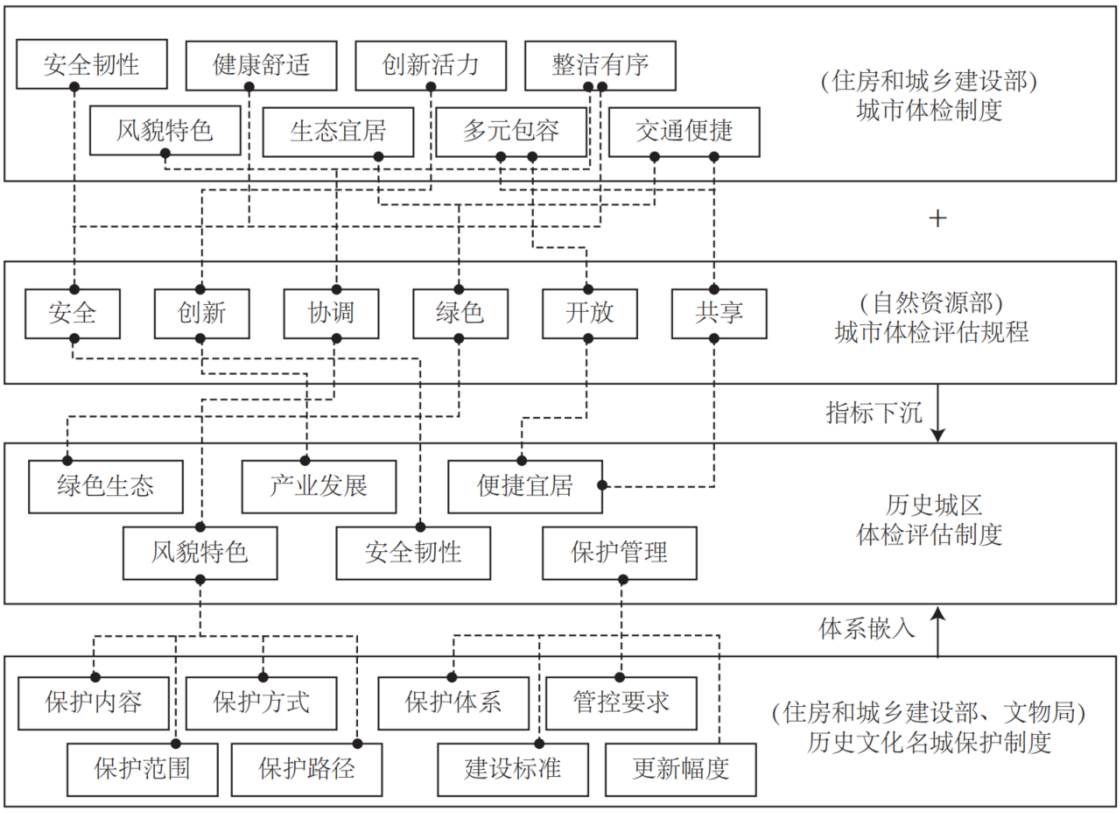

Fig.3 The system structure of examination assessment at the city level


绿色生态
绿地率/%
水面率/%
水功能区水质达标率/%
人均公园绿地面积/m²
人均绿道长度/m
街道绿视率/%
空气质量优良天数/d
热岛强度/℃
绿色交通出行比例/%
绿色建筑占比/%
再生水利用率/%
每万元GDP能耗/tce
每万元GDP水耗/m³
……
产业发展
年度GDP总量/万元
年度GDP增长率/%
年度文旅经济产值/万元
年度投资总量/万元
年度游客数量/人
文化品牌数量/个
社交媒体讨论热度/%
……
便捷宜居
人口密度/（万人/km²）
空间品质满意度/%
人均公共服务设施用地（教育、文娱、体育）面积/m²
每千人口公共服务设施（医疗、卫生、养老）床位数/张
基本公共服务设施覆盖率/%
基本公共服务设施15 min步行可达率/%
停车泊位与小汽车拥有量的比例/%
公共空间无障碍设施覆盖率/%
……
风貌特色
空间格局完整性/%
历史边界完整性/%
街巷肌理保存率/%
景观廊道通畅性/%
山水环境原真性/%
城市色彩协调性/%
天际轮廓连续性/%
历史地名保存率/%
街道风貌感知度/%
立面色彩协调度/%
市民生活丰富性/%
环境行为多样性/%
……
安全韧性
防洪堤防达标率/%
降雨就地消纳率/%
积水内涝点密度/（个/km²）
年平均地面沉降量/mm
人均应急避难场所面积/m²
消防救援5 min可达覆盖率/%
经过治理的地质灾害隐患点/处
各类管网普查建档率/%
综合减灾示范社区比例/%
社区卫生服务中心门诊分担率/%
城市每万人年度较大建设事故发生数/（个/万人）
存量土地供应比例/%
……
保护管理
历史街区/历史地段/历史建筑数量/个
历史街区/历史地段/历史建筑保护经费使用情况/%
历史街区/历史地段面积/km²
历史街区/历史地段保存完整率/%
保护建筑平均密度/（个/km²）
保护建筑挂牌率/修缮率/利用率/%
数字化信息采集和测绘建档比例/%
历史环境要素遗存数量/个
古树名木维护比例/%
非物质文化遗产收集/整理/保存情况/个
非物质文化遗产传承人档案记录情况/个
非遗项目对于地方社区发展/旅游经济的贡献率/%
违反保护规定事件/报道/个
保护管理规定/保护规则/技术标准制定情况/项
日常巡查管理制度建立和执行率/%
年度自评估工作中的合格指标比例/%
第三方机构评估工作中的合格指标比例/%
评估问题整改方案制定/实施/跟踪/督导情况/%
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Fig.4 Preliminary framework of examination assessment index system in historic urban areas

Specifically, the design of the physical examination and evaluation system at the historical district level should address the following issues. First, from the perspective of urban renewal, it is necessary to break through the previous limitations confined to the protection area of historical districts and release the historical districts from the protection system. The physical examination and evaluation of historical districts must adopt a perspective that shifts from "separation" to "integration." Second, the evaluation should be guided by the behavior trajectories, activity ranges, and daily needs of residents in both historical districts and surrounding communities. It should analyze which surrounding communities are closely connected to the historical district, with shared facilities, resource sharing, and social co-construction. Third, based on boundary opening and the integration of domains, the spatial reorganization of the block and community should take place, and the structural unit of "historical district—surrounding community" should be redefined to participate in the physical examination and evaluation process. Historical districts and surrounding communities should be regarded as a social spatial aggregate, in order to deploy effective and relatively scientific evaluation work. This approach will avoid artificially defined protection boundaries that sever the actual spatial connections and organic organization, thus preventing limitations in the physical examination and evaluation system.

2.3 Building Level: Content Supplement, Consideration of Both Internal and External Factors, Coordinated Element Management

Finally, the construction of the physical examination and evaluation system at the building level needs to be addressed. It is important to recognize that within the historical district, there are both protected buildings (historical buildings, cultural heritage sites, traditional buildings, local residences, etc.) and historical environmental elements (ancient trees, wells, stone steps, embankments, piers, inscriptions, statues, place names, historical stories, etc.), as well as other structures and environments that do not have explicit protection status or are not included in the protection list. These may include older buildings from the 1970s-1980s, and a small number of industrial factories (most of which have been vacated or relocated).The construction of the historical district physical examination system should take into account both protected and non-protected buildings and their overall needs, reflecting the issues present at the building scale within the historical district as a complete living unit.

The physical examination and evaluation at the building scale should not be limited to indicators such as the building's quality, appearance, structure, form, and function. It should also encompass both the external environment and internal functions of historical and modern buildings. The external environment includes public activities, civic vitality, place memory, spatial organization, walkway systems, site entrances and exits (their location, number, openness, and visibility), architectural spatial relationships, vegetation and landscaping, and line-of-sight accessibility. Internal functions include indoor lighting, ventilation, thermal comfort, energy consumption, circulation relationships, functional zoning, and forms of adaptive reuse.The system of physical examination and evaluation at the historical district level should encompass the internal space, external environment, and the building itself. By expanding from partial assessments to an overall consideration of the building, this system achieves content supplementation, balanced internal and external considerations, and coordinated management

of elements.

3 The Institutional Form of Historical District Physical Examination and Evaluation

The physical examination and evaluation of historical districts integrates the institutional connotations of both the protection of famous cities and urban physical examinations, achieving a transition from "separation" to "integration." To some extent, the physical examination and evaluation of historical districts could operate independently of the regular physical examination procedures, serving as a specialized evaluation system for historical and cultural cities, reflecting the unique value of the historical built environment. However, it is also important to note that the built environment represented by historical districts is an inseparable part of contemporary urban spaces. Urban-level physical examination and evaluation should include these built environments within their scope and consider them in the process of developing evaluation procedures and indicator systems.

In practice, however, the boundaries of most historical districts do not align with the current administrative divisions. As a result, the physical examination and evaluation of historical districts can only be treated as a special evaluation, which is directly integrated into the urban-level physical examination framework. It is difficult to wedge it into the existing urban evaluation system, which is based on administrative divisions, and build a system through hierarchical descent and upward aggregation. Currently, urban physical examination and evaluation are more suitable for modern urban spaces, while the physical examination of historical districts has become a "twin" system to the protection of famous cities, making it challenging to advance tasks aimed at updating and transforming the area.

The differences between the spatial divisions of historical and cultural units (historical districts—historical blocks—historical buildings) and administrative divisions (city—district—street) form two distinct spatial organizational relationships. Of the 143 historical and cultural cities to date, only a few have well-preserved historical districts with clear boundaries, which are designated as "streets" within the administrative unit for urban governance and corresponding social work. For example, the jurisdiction of the Pingyao Ancient City Street includes the area within the city walls (which roughly corresponds to the historical district), and it administers five communities: Bijingbao, Haizi Street, Zhanmadao, Yingxunmen, and Helanqiao. Similarly, in 2014, the ancient city of Xiangyang established the Ancient City Street as a township-level street office under the jurisdiction of Xiangcheng District, managing 15 communities, including Yangjiahuayuan, Mawangmiao, Huimulin, and Zhaomingtai.For these types of historical districts, the physical examination and evaluation can be horizontally integrated into the "street" administrative level, with the historical district evaluation process needing to be implemented at the community level. Furthermore, this integration "forces" the improvement of the physical examination and evaluation indicator system at the city (or district) level. Urban physical examination and evaluation should consider the heterogeneous characteristics of different types of built spaces and consolidate them in the top-level design. The data and information provided by historical districts will complement the current physical examination system, filling the gaps in the evaluation of historical built environments. This includes not only legally protected historical districts, historical blocks, and cultural heritage areas but also old cities and old districts, which serve as the origin of urban development but lack legal

protection status. By establishing a horizontal connection between "district—street," the existing urban physical examination system framework can be improved and provide insights for the design of evaluation indicators at the city and district levels.

Furthermore, historical urban areas that are fragmented by administrative divisions such as "streets" or even "districts" (e.g., the historical district of Xi'an spans the Beilin, Xincheng, and Lianhu districts, and includes multiple streets and communities) can be integrated into the "community" level of the urban physical examination and evaluation system through the structural unit of "block—community." At the lower level, the social spatial aggregate of historical blocks and surrounding communities can be the subject of physical examination and evaluation, addressing issues such as convenient services, community greening, property management, community governance, housing security, and neighborhood relationships with precise assessments and effective evaluations. At the upper level, this information can be aggregated at the "street" level, filling the gaps in the existing physical examination and evaluation indicators.

By identifying the coupling "interface" between historical cultural units and administrative divisions, the physical examination and evaluation of historical urban areas can be integrated into the "top-down" transmission system of urban physical examinations (Figure 6). In a unified, renewal-oriented urban physical examination context, historical district renewal and governance work can be carried out, clarifying that historical districts, as complete historical residential units, still require attention to urban space issues beyond protection.

It is essential to clarify that the physical examination and evaluation of historical urban areas should not be regarded solely as a protection-focused task. It must return to the urban physical examination evaluation procedures with a renewal-oriented focus, and in this process, "push" the construction and improvement of physical examination evaluation indicators at different levels. This will enable a comprehensive understanding of the content that needs to be evaluated in the overall urban space and enhance the practicality of the physical examination and evaluation system.

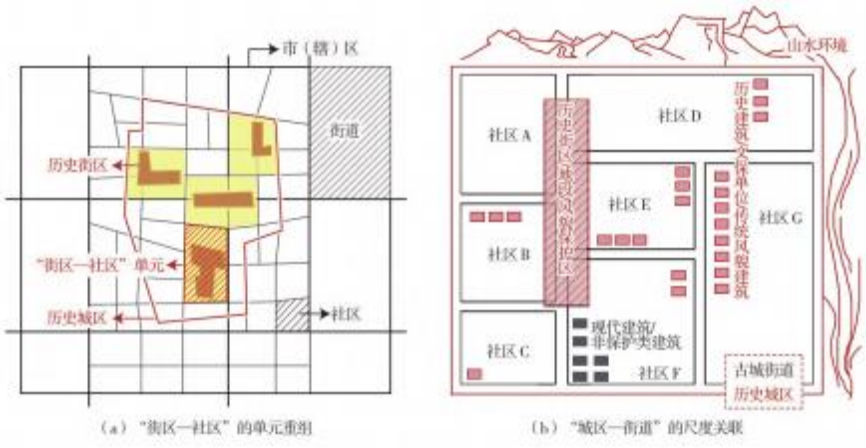

Fig.5 Unit recombination and scale correlation in examination assessment of historic urban areas

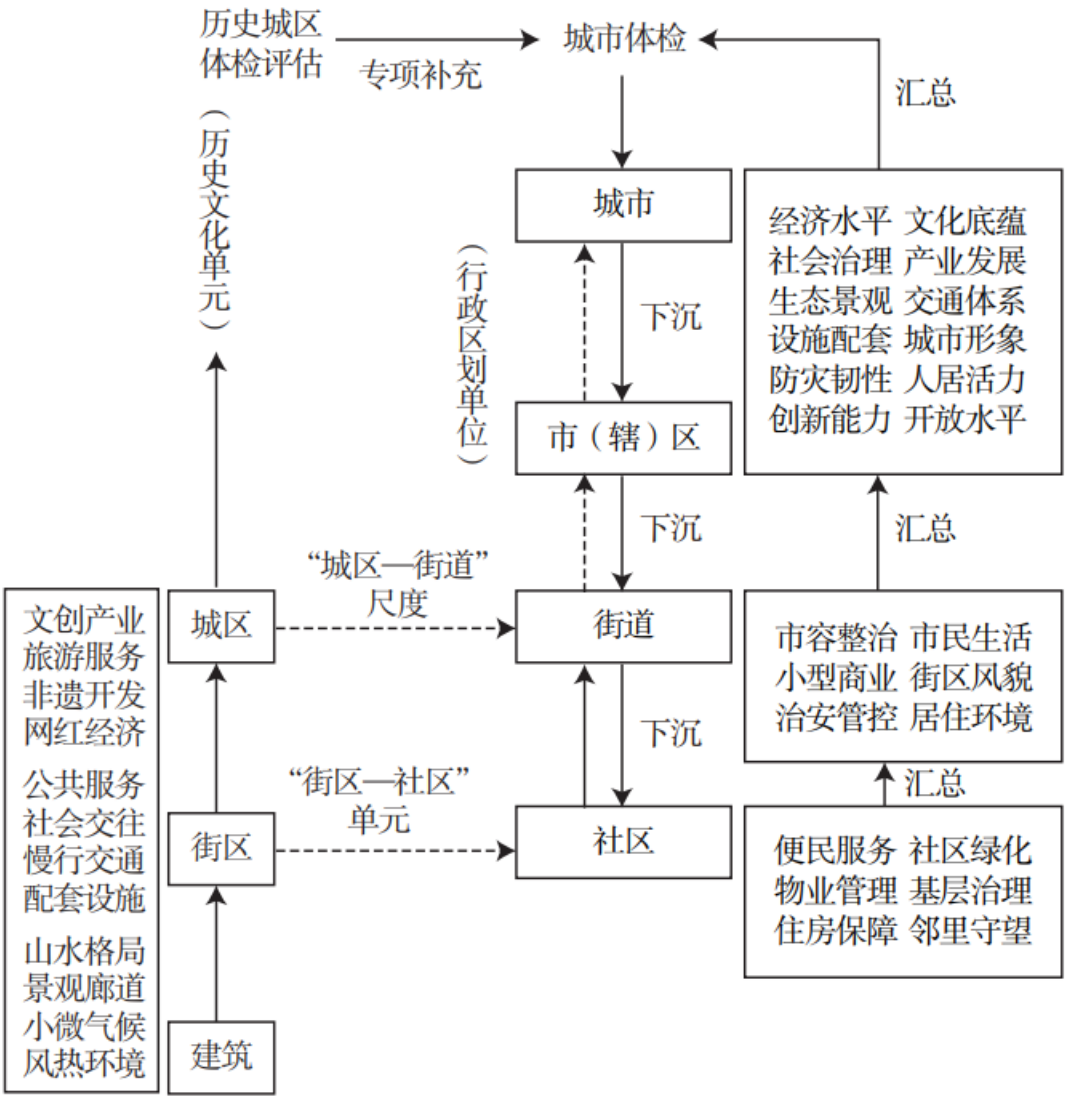

Fig.6 System of examination assessment for historic urban areas

4 The Institutional Goals of Historical Urban Area Physical Examination and Evaluation

In the process of development, historical urban areas have accumulated numerous construction-related issues. For example, during the "retreating industry and advancing services" process, there was a lack of overall planning for the industrial system of historical urban areas; large-scale cultural tourism projects and real estate development led to "shock-style" renovations and "bulldozer-style" demolition and rebuilding of historical districts; there is heavy traffic pressure, high population density, and insufficient supporting infrastructure in historical urban areas. Against this backdrop, governments often attempt to reduce population density and balance facility distribution by guiding population migration and optimizing the structure of historical districts. However, some local governments use this as an opportunity to focus on the land value of historical districts under the influence of real estate development and cultural tourism economics, forcibly relocating original residents through large-scale migration. As a result, historical urban areas, lacking residential vitality, become "cultural shells" and "scenic backdrops," leading to the erosion of historical and cultural values [37]. These issues are not

merely urban renewal problems, but are closely related to urban governance and protection, forming a chain of interlinked issues that, when touched, affect the whole. Therefore, when returning to the urban physical examination evaluation procedures, the institutional construction of historical urban area physical examination and evaluation needs to integrate related topics such as urban renewal, governance, and protection, and further reflect on these issues within the institutional goals of historical urban area evaluation.

4.1 Demand-Driven Approach: Promoting Fine-Tuned Governance of the Living Environment in Historical Urban Areas

Given the construction-related issues left behind during the development of historical urban areas and the practical needs for renewal and transformation, the physical examination and evaluation system for historical urban areas can directly serve as a guide for fine-tuned governance of the living environment. It can be applied to daily tasks such as the management, control, supervision, and coordination of historical districts. In this context, the evaluation data can serve as a reference to support the fine-tuned governance of historical urban areas, integrating it into the urban fine governance project platform. Through the evaluation, diagnosis, improvement, inspection, and re-evaluation process, this system can be connected with the digitalization and fine governance system for the living environment [38].Based on this, a work plan for dynamic monitoring, regular evaluation, problem feedback, decision-making adjustments, and continuous improvement can be established, enabling the integration, sharing, and interconnection of urban work data. By regularly maintaining data and tracking physical examination results, phase-specific maintenance information can support urban operation monitoring and fine-tuned governance tasks.

At the same time, real-world challenges and special circumstances encountered during the fine-tuned governance process can "feedback" into the urban physical examination and evaluation system, supplementing specific issues that cannot be captured by purely quantitative data, thus enhancing the applicability of the urban physical examination system. Compared to other types of built spaces, historical districts face more complex environmental and interest structures [39-40]. Purely quantitative data often has limited effectiveness, and universal and established evaluation systems may not reflect the unique value characteristics of each historical city. In this context, through the fine-tuned governance practices of historical districts, issues discovered can be fed back into the urban physical examination platform through qualitative evaluation and demonstration, addressing gaps or indicators that are difficult to quantify, thereby promoting the resilience of the institutional system.

It should be clarified that both urban physical examination and fine-tuned governance are institutional systems oriented towards humanism, serving urban residents as the target group, and aiming to improve the living environment as the ultimate goal. Therefore, public participation in physical examination evaluation and urban governance actions is necessary. In terms of the structure, content, and weight assignment of the urban physical examination indicator system, it is important to understand the key issues that local residents and the general public consider problematic, requiring diagnosis, and needing resolution. This helps expand the policy-making stakeholders and strategic layout of the physical examination and evaluation system [41].Under the demand-driven approach, the institutional construction of historical urban area physical examination and evaluation will promote bidirectional feedback and reciprocal

construction between the urban physical examination evaluation and fine-tuned governance work platforms (Figure 7). The public feedback during the fine-tuned governance process can also be supplemented from a "bottom-up" perspective into the "top-down" urban physical examination indicator system.

4.2 Bottom-Up Support for the Implementation of the City-Level Protection and Inheritance System

The physical examination and evaluation of historical urban areas should also effectively support the implementation of the city-level historical and cultural protection and inheritance system. In 2021, the General Office of the CPC Central Committee and the State Council issued the "Opinions on Strengthening Historical and Cultural Protection and Inheritance in Urban and Rural Construction," which clearly stated that historic and cultural cities, towns, villages (traditional villages), districts, immovable cultural heritage, historical buildings, historical sites, etc., should be considered as an organic whole for protection and inheritance. National and provincial-level protection and inheritance systems mainly emphasize strategic and coordinated aspects, while the city and county-level systems focus on the implementation of the work [42].

For historic and cultural cities centered on historical districts, which have a rich historical accumulation, they are the focus of city-level historical and cultural protection and inheritance work. Through the physical examination and evaluation, these districts provide a bottom-up support for the implementation of the city-level protection and inheritance system. For example, the construction of the historical and cultural protection system in Xi'an has expanded its scope to the Xi'an metropolitan area, creating an overall protection framework that includes "one core, two axes, two corridors, and three belts," which covers all aspects and timespans, with the "one core" referring to the protection core area of the historical and cultural city (i.e., the historical district) [43]. The results of the physical examination and evaluation of historical districts should serve as the "starting point" for the implementation of the city-level historical and cultural protection and inheritance work. They should reflect the current status of protection, inheritance, and update management in the district, accurately focus on areas of deficiency, and implement improvements.Further, the broader historical and cultural protection and inheritance system can expand from this foundation, breaking through the spatial limits of historical districts, and shifting from "district" to "region." This forms an overall citywide protection pattern for the urban environmental landscape and natural mountain-water conservation, achieving a comprehensive understanding of protection and inheritance tasks (Figure 8). The institutional construction of historical urban area physical examination and evaluation should also enhance the overall service level, improve basic living functions in the district, and create livable, business-friendly, and vibrant urban spaces, which act as the vitality engine for urban innovation industries. This should be integrated with the city-level urban and rural protection and inheritance system, achieving the organic combination of protection and inheritance.

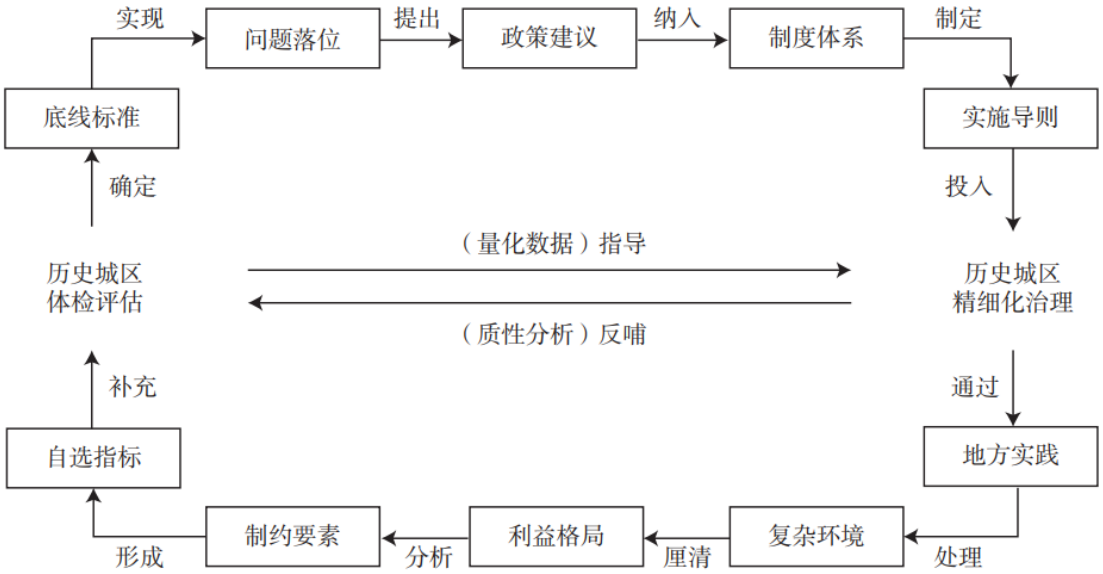

Fig.7 Correlation mechanism between examination assessment and refined governance of built environment in historic urban areas

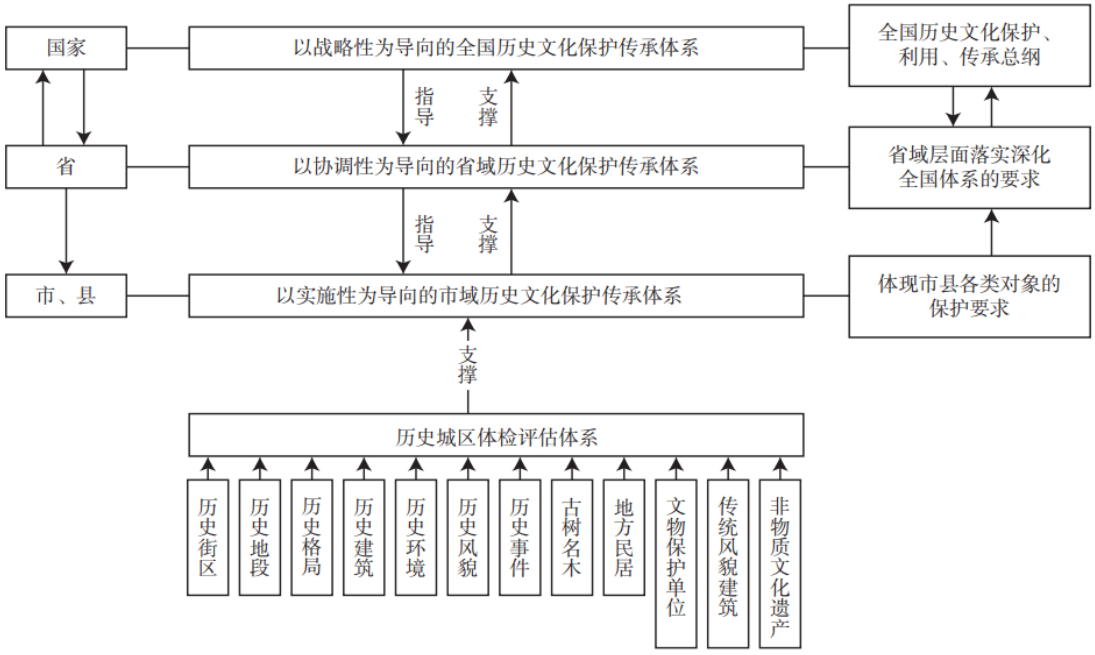

Fig.8 From "district" to "region": Supporting the municipal historical and cultural protection and inheritance system with the examination evaluation of historic urban areas

5 Conclusion

The physical examination and evaluation system for historical urban areas is a complex framework that involves various aspects such as protection, renewal, control, construction, and governance. Currently, the overall urban physical examination system has only begun to address historical urban areas as a type of urban space, and existing research has yet to formally delve into the historical built environment. Therefore, it is difficult to immediately construct a relatively

complete institutional framework. This paper, under these research conditions, addresses the issue of integrating the two institutional systems of historic city protection and urban physical examination evaluation. Using system coupling theory as a tool, it explores the construction logic of the historical urban area physical examination and evaluation system, providing theoretical insights for the subsequent comprehensive construction and practical exploration of urban physical examination systems.

The corresponding research content is divided into two main parts: The first part reviews the existing historical urban area physical examination and evaluation system, clarifying the current institutional foundation, identifying potential issues, and proposing a targeted theoretical explanatory framework. The second part, under theoretical guidance, explores the theoretical path for constructing the historical urban area physical examination and evaluation system, highlighting the levels (urban area, block, building) and directions (system integration, unit fusion, element coordination) in the construction process, and clarifying the corresponding institutional logic, institutional form, and institutional goals.

Based on this, the study yields the following two main conclusions:①Construction Logic of the Historical Urban Area Physical Examination and Evaluation System. First, the physical examination and evaluation framework at the urban area level should be constructed through the downward integration of the urban physical examination system's indicators and the structural embedding of the historic city protection system—guided by the "integration" of the evaluation system. Second, under the domain integration relationship, the "historical block—surrounding community" community should be fitted into a meaningful evaluation category at the block level—guided by the "reorganization" of the evaluation subjects. Lastly, at the building level, both protected and non-protected buildings should be grouped together for evaluation—centered around the "coordination" of evaluation elements.②In the Coupling of Administrative Divisions and Historical Cultural Units, the institutional form of historical urban area physical examination and evaluation needs to reflect the horizontal connections of "urban area—street" and "block—community," embedding the historical urban area physical examination into the "top-down" transmission system of urban physical examination. On one hand, this will promote the construction of urban physical examination indicators and improve the existing evaluation system; on the other hand, it will effectively connect the historical urban area physical examination with urban governance and protection work, advance fine-tuned governance of the living environment, and support the implementation of the city-level protection and inheritance system, achieving the integration of institutional goals—from "separation" to "integration."

As a complex residential space covering neighborhoods, communities, and blocks, historical urban areas need to highlight the complex attributes and diverse values of historical preservation and urban renewal in the local practices of physical examination and evaluation. In the next phase, research on historical urban area physical examination and evaluation should, based on the construction logic, further develop the corresponding indicator system, including types of indicators, statistical methods, data sources, evaluation standards, and evaluation objectives. At the same time, by combining local practices and specific cases of physical examination and evaluation, more specific work procedures and organizational methods should be developed to align the tasks of physical examination and evaluation at different spatial scales and levels, ensuring the stable operation of the institutional system. The physical examination and evaluation of various types of historical built environments have their unique complexities and

value characteristics. It is necessary to clarify their common features as components of urban space and interpret them holistically within the integrated context of "special" and "general," "precise" and "standard," and "historical" and "contemporary."

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