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From barriers to solutions: Advancing circular construction for sustainable growth

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Abstract

China's construction sector has become a key area for national sustainable development reforms, one of the largest and most resource-intensive industries globally. Despite the government's initiative to introduce multiple circular construction-related policies, significant challenges remain in areas such as fragmented standards, weak regulatory mechanisms, and the absence of end-to-end tracking. This study aims to evaluate the implementation performance of China's circular construction policies, identify core obstacles in institutional operations, and draw on governance experiences from European countries to propose feasible recommendations for institutional optimization. A qualitative research method was employed, including targeted content analysis of policy documents and comparative case studies of three pilot cities in China, to comprehensively assess the operational status of policies. Despite ongoing improvements to the policy framework, implementation challenges persist, including inconsistent standards, insufficient enforcement mechanisms, and weak integration of life-cycle concepts. Recommendations include incorporating life-cycle assessment tools into mandatory policy frameworks, establishing a unified building data platform, enhancing extended producer responsibility mechanisms, and driving the transformation of China's construction industry toward a more resilient and internationally aligned circular system.

Keywords: Circular economy, Green building governance, Institutional reform, International comparative study, Policy implementation.

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1. Introduction

1.1. Background

In response to the growing global challenges of climate change, resource scarcity, and environmental degradation, the circular economy has emerged as a strategic framework for achieving sustainable development goals. Notably, the

construction industry, one of the most resource- and carbon-intensive sectors, has gained increasing policy attention globally due to its potential to drive low-carbon transformation [1, 2]. However, despite its critical role, the global construction sector has yet to leverage circular economy practices fully. Many countries continue to rely on linear resource consumption models, leading to significant amounts of construction and demolition waste, high energy demand, and hidden carbon emissions. According to the 2023 Global State of the Construction Industry Report, the sector accounts for 37% of global energy-related carbon dioxide emissions, underscoring the urgent need for structural reform [3]. As international consensus grows on integrating circular principles into building environment policies, life-cycle thinking and waste minimization have become core pillars of sustainable building strategies in the EU, Nordic countries, and developing regions [4].

1.2. Chinese Context: Circular Construction Policy in China

China's construction activities place enormous demands on energy, materials, and land resources, making the transition to a circular economy in the construction industry critically important. In 2020 alone, China generated over 2.4 billion tons of construction and demolition waste, with recycling rates estimated to be below 10% in many provinces [5, 6]. The environmental and economic impacts of these figures have prompted an increasing number of national and local regulations to promote green building standards, waste utilization, and life-cycle-based design.

In recent years, China has introduced key policy documents aimed at promoting green construction and the recycling of construction waste. These include the Ministry of Housing and Urban-Rural Development [7], the Action Programme for the Creation of Hu, et al. [8], and the Guidance on Green Transformation of the Construction Industry under the Dual Carbon Strategy , which together form the backbone of the country's circular construction policy framework [6, 9].

However, from the perspective of policy implementation, the current institutional system still faces many challenges, including the lack of uniformity in the standard system, ineffective implementation of local policies, and insufficient incentives for enterprises to participate [10] Recent studies emphasize that persistent institutional issues such as governance fragmentation, ineffective enforcement of standards, and a lack of market incentives continue to hinder the achievement of policy objectives, thereby affecting the systematic advancement of green transformation in the construction industry [11].

1.3. International Perspective: Key Takeaways from the EU

Meanwhile, the EU has accumulated relatively mature governance practices and policy frameworks in circular construction, and its policy tools in Life Cycle Assessment (LCA), building material recycling standards, green public procurement, etc. provide important comparative references for China [12]. Under the framework of the global Sustainable Development Goals (SDGs), it is of great theoretical significance and practical value to explore in depth the governance differences and convergence trends between China and Europe in the field of circular construction. With the update of China's green building materials certification system in 2023 and the introduction of the Guidance on Green Transformation of the Construction Industry in the Context of the Dual Carbon Strategy, the institutional system of China's construction industry is stepping into a more systematic transformation stage [6, 13].

2. Literature Review

2.1. Research and Development of Circular Economy in Construction

With the advancement of the global sustainable development agenda, the circular economy has gradually become one of the key paths for the green transformation of the construction industry. As a sector with high resource consumption and high carbon emission intensity, the construction industry contains room for the implementation of circular concepts in material selection, building design, construction management, and waste disposal [14]. In recent years, researchers have conducted extensive research on green buildings, life cycle governance, and the reuse of building materials. For example, Khadim, et al. [15] argue that a sound circular building framework requires the development of clear metrics and performance assessment indicators. Similarly, Andersen, et al. [16] emphasize the institutional prerequisites for integrating circular principles into the EU's building materials system, especially through carbon reduction and regulatory instruments.

Wu, et al. [17] revealed the challenges faced by China's circular building policy at the institutional implementation level through empirical research; meanwhile, Velter, et al. [18] emphasize the key role of business model innovation and stakeholder synergy in promoting the construction of a closed-loop system in the construction sector. Overall, existing studies have laid a solid theoretical foundation for understanding the development path of the circular economy in the construction sector. However, most of them still focus on the project level or technical path, and lack in-depth exploration of the institutional structure and policy implementation mechanism, particularly regarding fragmented governance, weak enforcement systems, and insufficient coordination across regulatory bodies [19-21].

2.2. Institutional Barriers to Green Building Policies in China

In recent years, with the promotion of the ‘dual-carbon’ strategy, China's green building and recycling construction policy system has become more and more perfect, and relevant policy documents have been issued continuously [6, 13]. However, at the implementation level, there are still structural barriers such as inconsistency in the standard system, insufficient local implementation efforts, and low motivation of enterprises to participate in the process [17]. Lagging regulatory mechanisms and inadequate data tracking systems hinder the implementation of construction waste recycling policies [19].

In the implementation of policies related to the resource utilization of construction waste, issues such as lagging supervision mechanisms and insufficient data tracking have been identified. From the perspective of project managers, small and medium-sized enterprises (SMEs) show little interest in green building, and their awareness of green building and recycling is insufficient. Based on the perspective of project managers, it was found that SMEs exhibit a weak response to green building policies, primarily attributed to cost pressures and the absence of mandatory incentive measures [22].

In addition, the system of policy tools is mainly based on administrative orders and demonstration projects, and lacks a systematic performance evaluation mechanism and a cross-regional policy coordination mechanism Chen and Chen [23].Liu and Yang [24] also point out that local governments often face unclear target decomposition, insufficient financial support, and fragmentation of supervisory functions in the implementation of green policies, which restricts the realisation of policy effects, and the effect of the policy is limited.

2.3. Comparison of International Systems and Policy Reference Studies

Internationally, the European Union (EU), the Netherlands, and the Nordic countries are widely recognised as forerunners in the design of circular construction systems. The EU's 'Level(s)' system provides a standardised framework for building life cycle assessment (LCA), including key indicators such as carbon footprint, environmental costs, and health performance [25].In the Netherlands, LCA has been increasingly mainstreamed into the building policy system through public procurement standards and performance-based regulations, thus creating a closed-loop mechanism throughout the building life cycle [26].

In addition, green procurement (GPP), extended producer responsibility (EPR), and green building certification systems (e.g., BREEAM, DGNB) play an essential role in incentivizing firms to participate in the circular transition. These institutional tools provide valuable insights for China's policy reforms, especially in embedding market mechanisms into environmental governance [27].

In contrast, China has yet to establish a unified life cycle assessment mechanism for green building materials and an environmental information disclosure platform. China also lacks a stable cross-sectoral governance structure and consistent green incentive tools, leading to fragmented policy design and uneven implementation [24].

2.4. Research Gaps and Positioning of this Study

Existing studies have accumulated a large number of results in terms of technical pathways, local governance, and project cases of circular construction. However, there are still obvious research gaps at the institutional level: Lack of structured and systematic assessment of the implementation performance of circular construction policies in China; Lack of analysing the differences and structural deficiencies between Chinese and foreign policy instruments from the perspective of institutional integration and comparative method; Lack of institutional review studies that integrate and analyse life cycle concepts, cross-sectoral governance and market mechanisms.

This study responds to the above gaps by analysing the policy documents and case cities, evaluating the performance of China's circular construction policy from the three dimensions, policy goal achievement, implementation mechanism operation, and market response, and proposing institutional reforms in terms of life-cycle tools, institutional integration logic, and market-driven mechanism with the help of the EU experiences. We proposed institutional reforms in terms of life cycle tools, institutional integration logic, and market-driven mechanisms, aiming to promote China's green building policy from document-intensive to system-integrated.

2.5. Research Questions

The following research questions guide this study:

RQ1: How effective is the circular construction policy in China?

RQ2: What are the key policy and regulatory gaps between China's and European circular construction frameworks?

3. Research Methodology

3.1. Qualitative Research Approach

This study adopts a qualitative research method, focusing on the institutional level rather than the individual level, and primarily relies on policy texts and authoritative literature to conduct institutional performance evaluations.

3.2. Secondary Data Analysis

The secondary data used in this study mainly from the following three types of policy documents, all of which are public documents released by the Chinese government or international institutions in recent years. The data is authoritative and highly accessible, forming the basis for institutional analysis.

Table 1.
Sources of Policy Documents Used.

Data type	Representative documents	Source institutions
Green building policy	The 14th Five-Year Plan for the Development of the Construction Industry (2022)	Ministry of Housing and Urban-Rural Development (MOHURD)
National development plans and industry guidelines	Green Building Creation Action Plan (2020); Guidance on the Green Transformation of the Construction Industry under the Dual Carbon Strategy (2021)	National Development and Reform Commission (NDRC); Ministry of Housing and Urban-Rural Development (MOHURD)
Circular economy strategies	Annual Report on China's Circular Economy Development (2023); Global Status Report for Buildings and Construction (2023)	China Circular Economy Association; UNEP & GlobalABC

3.3. Case Selection

To strengthen the empirical foundation of this study, three cities, Shanghai, Shenzhen, and Suzhou, were selected as typical cases. All three cities are regions that have been at the forefront of promoting green building policies; they have a high degree of information transparency, and they exhibit representative differences in the design and implementation of policy tools [10]. For example, Shanghai: In 2021, it released the "Green Building Development Action Plan" and established a green construction digital platform; Shenzhen: In 2020, it implemented mandatory design standards for green buildings; Suzhou: In 2022, under the "dual carbon" context, it launched a pilot project for building recycling.

3.4. Case Selection Criteria

(1) The presence of local policies on green or circular construction.

(2) The availability and transparency of policy implementation data, such as reports from official government portals and relevant platforms.

(3) Regional representativeness, with a focus on developed eastern provinces and ecological pilot zones;

(4) The overall accessibility and openness of relevant data sources.

3.5. Data Analysis Methods

This study used two primary data analysis methods: Directed Content Analysis and Comparative Policy Analysis. These methods combine theoretical models with empirical research on policy texts to provide an in-depth analysis of the effectiveness of policy design and implementation at the institutional level, thereby establishing a robust theoretical foundation and comparative framework for this study.

First, Directed Content Analysis is primarily used to organize and code policy texts from China and the EU to identify commonalities and differences in institutional embedding and implementation mechanisms. This method, proposed by Hsieh and Shannon [28], emphasizes the purposeful categorization, comparison, and theme extraction of policy texts under the guidance of existing theories, making it particularly suitable for policy analysis research centered on institutional orientation. Combining theories related to the circular economy and green buildings, this study analyzes three key dimensions:

First, it examines the degree to which the concept of the life cycle is embedded in policy texts, specifically whether life cycle assessment is incorporated into mandatory regulations or policy frameworks. For example, the study will examine whether China's "Green Building Evaluation Standard" (GB/T 50378-2019) sets LCA indicators such as carbon emissions and material recycling rates. Second, it identifies structural bottlenecks in policy implementation, including the lack of a unified regulatory platform, fragmented technical standards, and poor policy coordination between different levels of government.

For example, in the area of construction waste resource utilization, there are significant differences between Shenzhen's local regulations and national technical guidelines, which increase the difficulty of policy implementation. Third, analyze whether cross-departmental coordination mechanisms are sound, particularly between key regulatory agencies such as the Ministry of Housing and Urban-Rural Development and the Ministry of Ecology and Environment, and whether there are mechanisms for goal decomposition and data sharing systems. For example, in the area of full-process traceability mechanisms for construction waste, there are still issues such as overlapping responsibilities, regulatory gaps, and information silos.

Targeted content analysis not only helps reveal institutional gaps within China's policy system but also provides a structured assessment framework for future international benchmarking studies.

Second, this paper adopted the Comparative Policy Analysis method to systematically identify differences and learning pathways between China and the EU in terms of circular construction institutional arrangements. This method emphasizes comparing policy objectives, tool structures, and implementation mechanisms across different countries or regions under a unified theoretical framework. It has become an important tool in green transition policy research in recent years. This paper focuses on the following three aspects for institutional comparison:

First, comparing the institutionalization of life cycle tools, particularly whether they are incorporated into mandatory construction processes and public approval systems. For example, the EU's "Level(s)" framework has been embedded into

building permit and green procurement systems by multiple member states, serving as a crucial institutional foundation for evaluating the full life cycle performance of buildings [25]; in contrast, China's LCA applications remain at the pilot stage in local areas, lacking unified technical standards and approval platforms [24].

Second, analyzing the maturity of market incentive mechanisms, including whether market-driven policies such as green procurement and extended producer responsibility have been institutionalized [27]. Taking the Netherlands as an example, its public project tenders explicitly require the submission of LCA scores [26], forming a closed-loop system of assessment, response, and feedback; in contrast, China has yet to establish a unified green building materials evaluation platform and lacks systematic market-oriented incentive tools. Third, examining whether cross-departmental policy implementation mechanisms are coordinated and unified.

The EU relies on cross-departmental platforms and regulatory coordination mechanisms in the implementation of circular construction policies. For example, the German Federal Institute for Building and Environment coordinates multiple departments such as housing, finance, and environment to promote green building material certification, LCA integration, and standardization of evaluation systems, forming a coordinated model that connects upper and lower levels [29]. In contrast, while some local governments in China have exploratory practices, the absence of a national-level coordination mechanism still results in policy fragmentation and fragmented implementation.

In summary, this paper systematically analyzes the characteristics of China's current policy system using directed content analysis. Then it combines comparative policy analysis to conduct a multi-dimensional comparative analysis of EU institutional practices. This approach not only highlights the core issues in the implementation of China's circular construction policies but also helps identify key directions for future institutional optimization and international benchmarking pathways.

4. Results and Discussion

4.1. Research Question 1: How Effective is the Circular Construction Policy in China?

This section evaluates the implementation effectiveness of China's circular building policies from three dimensions: the extent to which policy objectives have been achieved, the operational status of implementation and supervision mechanisms, and the response capacity of market entities.

4.1.1. Achievement of Policy Objectives

In recent years, China has introduced a number of policies related to green buildings and circular buildings, such as the Green Building Evaluation Standard (GB/T 50378-2019) and the Guidelines for the Resourceful Utilization of Construction Waste. However, relevant studies have pointed out that these policies generally lack quantitative indicators and have insufficient enforcement constraints [21].

Expressions in policy documents such as “improving resource utilization efficiency” and “promoting green building materials”—frequently cited in the Green Building Evaluation Standard (GB/T 50378-2019) and the Guidance on Green Transformation of the Construction Industry under the Dual Carbon Strategy—are often vague, lacking clear assessment milestones and incentive mechanisms, resulting in weak implementation at the operational level [9, 30].

At the local level, Shenzhen and Suzhou have respectively introduced the “Management Measures for the Resource Utilization of Construction Waste” and the “Green Construction Points System,” achieving some breakthroughs in operational feasibility. However, these local policies lack sufficient coordination with national standards, and discrepancies in standard definitions and technical guidelines further exacerbate policy fragmentation. In contrast, Shanghai has established a comprehensive green construction assessment platform, integrating construction entities, regulatory departments, and information systems into a closed-loop management system, with relatively clear objectives. However, this platform lacks legal support from higher-level legislation, making it difficult to replicate across regions.

4.1.2. Implementation Mechanisms and Supervision Systems

China's current circular construction policies involve multiple competent authorities, including housing and urban-rural development, ecology and environment, and urban and rural planning. However, the lack of effective interdepartmental coordination mechanisms has led to serious problems such as overlapping responsibilities, regulatory gaps, and information silos [31]. Most cities have not yet established unified digital supervision platforms, and the entire process of tracking construction waste from generation to reuse remains inadequate. Recent empirical studies also indicate that interdepartmental coordination and real-time data systems remain weak in most cities [32].

First-tier cities like Beijing and Shanghai have piloted digital supervision platforms, but most regions still rely on manual reporting, resulting in poor data quality and a lack of feedback mechanisms, which hinder policy iteration and risk warning [33]. For example, Shanghai has established a digital regulatory closed-loop system covering project application, construction management, and completion assessment; Suzhou primarily relies on offline registration and post-hoc spot checks; Shenzhen has introduced some digital tools, but data synchronization and real-time capabilities are insufficient to support dynamic regulation. Differences in technical and governance capabilities across regions directly impact the equity of policy implementation outcomes.

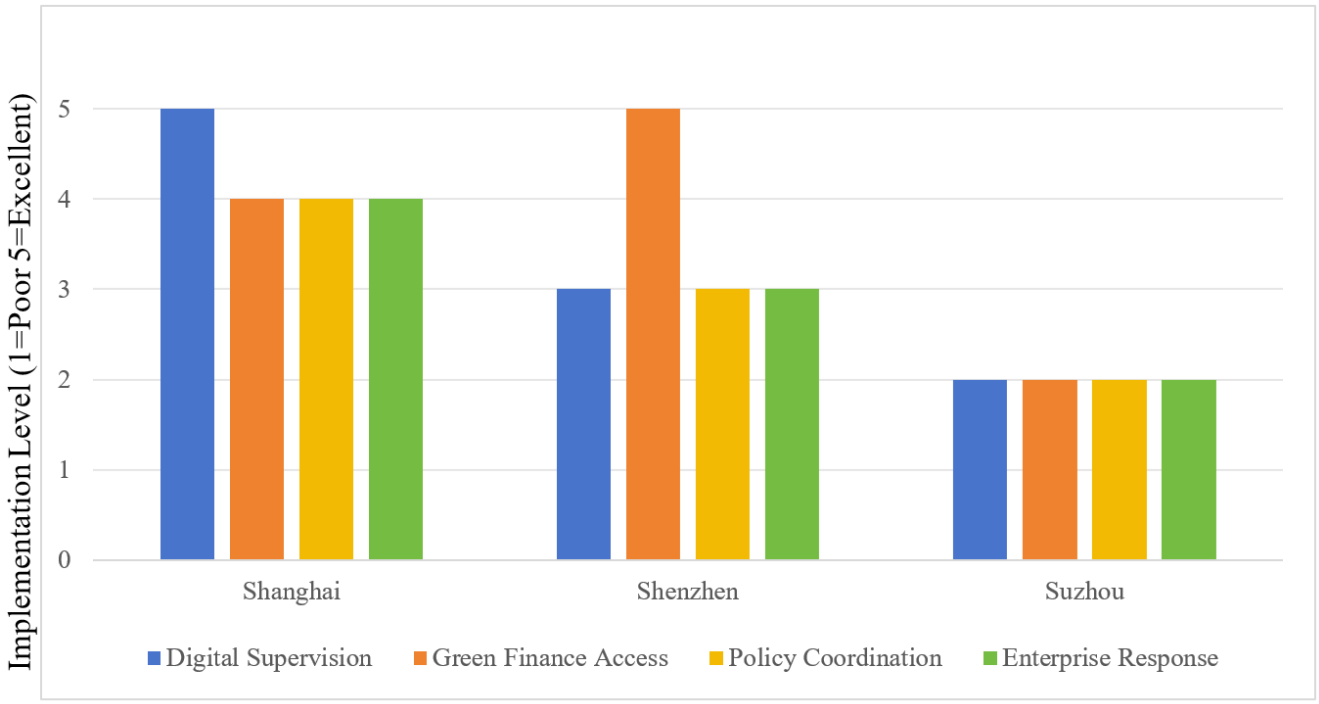

Figure 1.
Policy Implementation Comparison of Three City.
Note: Scores are derived from qualitative assessments of policy coordination, digital supervision, market responsiveness, and financial accessibility as described in the policy analysis.

To visually compare the implementation effectiveness across cities, Figure 1 summarizes four key dimensions of policy execution in Shanghai, Shenzhen, and Suzhou, based on the qualitative assessment of policy documents and local practices.

4.1.3. Market Response and Industry Adaptability

Although some leading enterprises have begun to adopt green building materials and waste reduction designs, most small and medium-sized enterprises face issues such as high costs, weak technology, and insufficient incentives, resulting in limited response to circular construction policies [34]. Insufficient access to green finance is a major barrier to SMEs' participation in green transformation. Existing green loans and special subsidies have narrow coverage and insufficient intensity, and lack institutional designs linked to performance [35].

Market responses vary across cities: Shanghai leverages green finance pilot programs to guide large state-owned developers in adopting green building materials and low-carbon processes, creating a case effect; Shenzhen is dominated by technology-driven enterprises with high green innovation intentions, but SME responses remain limited; Suzhou-based enterprises generally report difficulties in timely access to policy information and complex subsidy application processes, resulting in low participation willingness. This indicates that policy announcements alone are insufficient to stimulate market-driven transformation momentum, necessitating the integration of institutionalized incentives and service systems.

Additionally, lagging green technology standards and cumbersome approval processes hinder the promotion of new materials and processes. In the absence of mandatory constraints and effective incentives, enterprises' intrinsic motivation to advance green transformation remains insufficient. To illustrate the results of the targeted content analysis, Table 2 summarizes the main differences and institutional gaps between China and the EU's circular construction policies in terms of core analytical dimensions.

Table 2.
Policy Gaps Between China and the EU.

Analytical Dimension	Example from EU Policies	Example from China Policies	Gap Identified
Life Cycle Integration	Mandatory LCA in Level(s) framework	Pilot-level LCA in GB/T 50378-2019	No national LCA enforcement or standards
Market Incentives	GPP, EPR, Tax Benefits, Certifications (e.g., BREEAM)	Project-based subsidies, limited green loans	Lack of stable and systematic incentives
Cross-Sectoral Coordination	Multi-ministerial platforms and legal directives	Fragmented responsibilities, local self-reporting	Weak inter-agency collaboration and no national platform

Building on the previous comparison with the EU policy framework, a more detailed study of Chinese national policy texts was conducted. To complement the comparative analysis, Table 3 presents a structured content analysis of the five

key national policy documents identified in Table 1. It summarizes the codes extracted from these sources, recurring themes, and institutional insights.

Table 3.
Content Analysis of National Policy Documents.

Policy Document	Code Extracted	Theme	Analytical Insight
14th Five-Year Plan for the Development of the Construction Industry (2022)	Strategic goals: life-cycle reference without KPIs	Abstract planning with weak implementation instruments	Serves as top-level guidance, but lacks measurable or enforceable tools
Green Building Creation Action Plan (2020)	Green building promotion: weak enforcement details	Ambitious language but vague policy mechanism	Encourages green design, but no mandatory compliance structure
Guidance on the Green Transformation of the Construction Industry (2023)	Dual-carbon objectives; lacks LCA enforcement	Life-cycle thinking remains symbolic without institutionalization	References LCA but without platforms or accountability requirements
Annual Report on China's Circular Economy Development (2023)	Circular economy framing: no sector-specific targets	Systemic transition has an emphasis, but is limited to the construction sector	Positions the circular economy broadly but lacks industry-tailored policies
Global Status Report for Buildings and Construction (2023)	Slow decarbonization; underinvestment in building retrofits	The global building sector is off track toward net-zero by 2050	Despite recognition of urgency, global efforts and codes remain insufficient

Research Question 2: What are the key policy and regulatory gaps between China's and European circular construction frameworks?

This section compares and analyzes the circular building systems practices of China, the EU, the Netherlands, and Nordic countries around three key dimensions: the life cycle concept, regulatory coordination mechanisms, and market-based tools, and distills out experience paths that can be referenced.

4.1.3.1. Life Cycle Concept and Technical Tools

The EU has established a standardized indicator system, including carbon emissions, material recycling rates, and life cycle costs, centered on the Level(s) framework to institutionalize building life cycle assessment (LCA) [25]. Countries such as the Netherlands and Sweden have even incorporated LCA into mandatory standards, creating transparent and quantifiable green regulatory tools. In contrast, although China's policies have repeatedly emphasized "full-process green management," no unified LCA standards or implementation platforms have been established. LCA applications are primarily concentrated at the demonstration project level and have not been integrated into mainstream approval processes or performance evaluation systems, resulting in limited policy effectiveness [24]. Additionally, China has not yet established a national-level Environmental Product Declaration (EPD) system, lacking standardized disclosure of building material life-cycle information, which results in a lack of transparency and comparability in the application of green building materials [12].

4.1.3.2. Regulatory Coordination and Institutional Integration Mechanisms

The EU promotes the development of localized implementation plans by member states through legal directives and a multi-tiered governance structure, thereby establishing best practices for the management of construction and demolition waste [29]. For example, the Netherlands achieves policy consistency and enforcement through a ministerial coordination mechanism and the breakdown of local targets.

In China, however, the responsibilities of the Ministry of Ecology and Environment, the Ministry of Housing and Urban-Rural Development, and local governments are unclear, leading to regulatory overlaps and policy disconnects. While Shanghai and other regions have established relatively comprehensive green construction toolkits, most areas have not yet formed efficient collaborative systems due to capacity and resource constraints [36].

Policy evaluations primarily rely on self-reported data from local governments, lacking a unified assessment platform and real-time feedback mechanisms, which limits the ability to learn from and adjust policies.

4.1.3.3. Market Mechanisms and Responsibility Allocation

The EU has established a comprehensive market incentive mechanism through Green Public Procurement (GPP), Extended Producer Responsibility (EPR), and third-party certification systems (such as BREEAM and DGNB), which not only clarify corporate responsibilities but also promote long-term shifts toward green behavior [37].

In contrast, China still primarily relies on administrative directives and demonstration projects, with low institutionalization of mechanisms such as green finance and a lack of an accountable implementation framework. The construction sector has yet to establish a mature EPR system, green procurement has limited coverage and weak

enforcement, and the green building materials market faces issues such as insufficient credibility and inconsistent standards [12].

Additionally, green building materials lack a unified and transparent environmental performance assessment mechanism, posing a risk of "greenwashing," which is detrimental to the healthy development of the industry. Overall, a comparative analysis of Research Questions 1 and 2 reveals that China faces three key institutional challenges in circular construction governance: first, the absence of a unified life cycle assessment mechanism; second, insufficient interdepartmental regulatory coordination; and third, an incomplete market incentive mechanism. While some localities have engaged in innovative explorations, these efforts are difficult to replicate without national-level institutional integration. The research findings suggest that policy reforms should go beyond merely expanding the number of policies and instead focus on institutional consistency, vertical coordination mechanisms, and performance-oriented implementation systems. The following section will propose targeted institutional optimization recommendations.

5. Summary and Policy Recommendations

Against the backdrop of a deepening global sustainable development strategy, promoting the construction industry to realize green transformation and circular development has become an important goal of the policy system of various countries, which is reflected in the latest International Energy Agency [38] released by the United Nations Environment Programme (UNEP) and the Global Architecture Council (GlobalABC).

As one of the countries with the most active construction activities in the world, China's construction industry has long been at a high level in terms of resource consumption and carbon emission intensity, which has triggered widespread concern.

In recent years, the Chinese government has actively explored the development path of the circular economy in the construction sector through intensive policies. From the 14th Five-Year Plan for the Development of the Construction Industry Ministry of Housing and Urban-Rural Development [7], to green building evaluation standards, guidance on resource utilisation of construction waste, and financial support measures for green construction, a multi-level policy system covering planning, standards, regulation and incentives has been initially constructed, reflecting the increasing attention paid to the systemic nature of green transformation at the policy level.

Based on national policy texts and typical city practice cases, this paper systematically evaluates the institutional performance of China's circular construction policy in the three dimensions of 'policy goal realisation - implementation mechanism - market response', and proposes a targeted institutional performance based on a comparison with the institutional experience of the European Union and other countries. By comparing with the experience of the European Union and other countries, the study puts forward targeted suggestions for institutional optimisation. The study shows that China has formed a macro-policy matrix in terms of policy planning, technical standards, regulatory procedures and financial incentives in the design of its recycling policy, This coincides with recent IEA findings that fragmented policy implementation, unclear performance measures, and limited private sector incentives are long-term barriers to transforming China's construction sector [38].

Firstly, the policy objectives are generally expressed in abstract terms and lack operational details. Local governments and industry bodies lack clear technical guidance and performance evaluation standards in implementation, resulting in 'last-mile' obstacles to the implementation of the policy. Secondly, the regulatory mechanism shows a trend of fragmentation, housing construction, ecological environment, development, and reform, and other departments work separately, standards are not unified, there is a lack of coordination and information sharing mechanism, resulting in the system implementation costs, unclear responsibilities.

Third, the incentive mechanism has not yet formed a closed loop, and the green transformation of enterprises still relies mainly on administrative promotion, with insufficient endogenous market momentum. Although the Ministry of Housing and Construction (MOH&C) and the Ministry of Finance (MOF) jointly issued the Measures for Financial Support of Finamore and Oltean-Dumbrava [27], proposing to expand the scope of financial subsidies for green building materials, the policy coverage is limited. Feedback from enterprises has pointed to the complexity of the subsidy application process and low accessibility. There is still a lack of mandatory legal responsibility and systematic market guidance tools in key aspects such as the promotion of green building materials, the resourcing of construction waste, and the use of recycled materials.

In contrast, the circular construction systems in EU countries show a high level of institutional integration and synergistic governance. For example, the 'Level(s)' framework has been incorporated into the green building licensing mechanism in several member states. Green public procurement (GPP), environmental product declarations (EPD), and extended producer responsibility (EPR) work in tandem to realise the full process of institutional coverage from project source to product liability. These international experiences show that only through the organic integration of technical norms, economic incentives and legal constraints can a long-term institutional system be formed to promote the efficient operation of recycling construction.

6. Policy Recommendations

Based on the above findings, this paper puts forward the following four institutional optimisation recommendations to promote China's circular construction governance system from the juxtaposition of tools to the synergy of mechanisms: First, establish a clear and operable policy target system. Legally binding quantitative targets should be set for key indicators such as construction waste reduction, resource recycling rate, and carbon emission intensity, which should be embedded in project approval, performance evaluation, and government supervision processes to enhance policy rigidity

and clarify implementation responsibilities. Reference can be made to the European Union's practice of incorporating green targets into building permits and public bidding processes, so as to promote 'verifiable and accountable' targets.

Second, build a unified information platform for the whole life cycle of buildings. It should integrate environmental data from the entire process of design, construction, operation, and demolition to form a cross-sectoral shared data monitoring system. The platform should include functions such as an LCA assessment module, green building materials database, and construction waste tracking and reuse paths, which will not only improve regulatory efficiency but also provide support for green decision-making by enterprises.

Third, set up a national-level coordination mechanism for recycled construction. It is recommended to set up an inter-departmental coordination platform at the State Council level to unify policy content, technical standards, and financial resource allocation, and to promote coordination among departments of housing, ecology and environment, development and reform, etc. Local governments can also set up a joint meeting mechanism. Local governments can also set up joint meeting mechanisms to achieve consistency in policy content, convergence of implementation mechanisms, and interoperability of data systems.

Fourth, financial incentives and legal responsibility mechanisms should be promoted in parallel. Economic incentives such as green credit, green procurement, and tax breaks should be used to stimulate market participation, while at the same time accelerating the construction of an environmental responsibility system for the whole life cycle of building materials. It is recommended to introduce the EPR mechanism to clarify the legal obligations of building materials, development units, and construction enterprises in the process of waste generation and recycling, so as to realise the change from government-driven to market-driven.

7. Research Limitations and Future Research Directions

This paper mainly focuses on the top-level design and institutional performance evaluation of the recycling construction policy at the national level. Still, it does not explore the differences in policy implementation, innovation, and pilot practice of local governments, nor does it systematically analyse the behavioural logic and institutional constraints of different types of enterprises in the construction industry chain in the process of responding to the policy.

Future research can be deepened and expanded in the following three directions: Carry out empirical comparisons of cross-regional policy implementation performance, and identify the different paths of institutional adaptation and local policy combinations.

Focusing on the construction of the legal liability system related to green construction and the embedding of the judicial mechanism, and exploring the application space of environmental litigation and administrative enforcement in the construction field.

Systematically analyse the policy response behaviours and motivation mechanisms of developers, construction companies, design units, and other subjects at the micro level, to build a more enforceable and supervisable incentive-compatible policy portfolio, and to promote the policies from institutional supply to practical implementation.

Continuously expanding the research on institutional and behavioural dimensions will provide solid support for the construction of a recycling construction governance system that meets China's national conditions and is in line with international rules, This will also provide an academic basis and practical guidance on policy pathways to achieve high-quality, low-carbon development in the construction sector, which is consistent with the ESCAP [39] Roadmap for Advocating a Regionally Harmonized Circular Policy for the Construction Sector in Asia [39].

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