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Research On Spatial Planning Strategy From the Perspective of Circular Economy

Wanyun Ling

Faculty of Architecture, RWTH Aachen University, 52066 Aachen, Germany

ABSTRACT

Under the situation of the increasing shortage of global resources and the deterioration of the environment, circular economy, as a potential countermeasure, has gradually emerged as a key path to ensure the sustainable evolution of social economy. This study chooses the field of architecture as the starting point to analyze the application and improvement of spatial planning strategy from the perspective of circulation, hoping to realize the efficient closed loop utilization of resources. At the beginning of this paper, we summarized the essential characteristics of circular economy and its embodiment in the construction industry, and further studied the exemplary practice of circular economy in the European construction field, including policy support, demonstration projects and major obstacles faced. Then through the empirical investigation of the current situation of circular economy in China's construction industry, and compared with the examples in Eurasia, we explain the differences between China and the United States in this field and the causes. On the basis of these analyses, we construct a theoretical framework of spatial planning based on the concept of circular economy, design targeted tactics for different architectural schemes, and study the dynamic mechanism to ensure that the strategy takes root. Empirical evidence shows that accurate and adaptable spatial planning is tantamount to a significant improvement in the resource utilization of the construction industry, and also provides a strong support for regional and even national sustainable vision. Finally, we look forward to the future research blueprint, emphasizing the strengthening of international cooperation and dialogue to jointly meet the global difficulties, in order to accelerate the ecological and low-carbon transformation of the construction industry.

KEYWORDS

Circular economy; Spatial planning; Construction industry; Closed-loop utilization of resources; Europe; China.

1. INTRODUCTION

In the context of the depletion of global resources and the deterioration of ecological environment, circular economy, as a potential response strategy, is increasingly emerging as a key path to support the sustainable evolution of social economy. In this study, the architecture field is chosen as the focus, and the application and improvement of space allocation strategies are deeply investigated from the perspective of circulation, in order to promote the efficient use of closed loop resources. The paper starts by reviewing the essential definition of circular economy and dissecting its practice form in the construction industry. Then, we show the exemplary practice of circular economy in the European construction industry in detail, covering policy support, case verification and the complexity faced. Then, through the empirical investigation of the current conditions of the circular economy of the construction industry in our country and the comparison with the corresponding situation in Europe, we analyzed the differences and similarities between the two countries in this field and the fundamental factors that give rise to the differences. Based on this, we built a theoretical framework

of spatial planning based on circular economy, proposed customized implementation plans for various construction projects, and dug into the operating mechanism of these measures in real operation. Research shows that accurate layout planning can significantly improve resource efficiency in the construction industry, while providing a strong backbone for improving sustainability vision at the regional and national levels. Finally, we looked forward to the future research trajectory and reaffirmed the indispensability of strengthening international cooperation and communication to jointly address global challenges and promote the transformation of the construction industry to environmental protection and low carbon. This study attempts to fill this gap, and proposes a set of spatial planning strategies applicable to the construction industry through a comprehensive analysis of the practical experience of Europe and China.

2. THEORETICAL BASIS OF CIRCULAR ECONOMY

2.1. The definition and core idea of circular economy

As an economic development strategy that can optimize the use of resources, improve resource efficiency and control the breeding of waste, the core concept of circular economy model lies in the efficient circulation and reuse of materials, and the construction of a closed loop system framework, in order to achieve a permanent balance in the three dimensions of economy, ecology and society. Compared with the traditional economic form that follows the linear mode of operation - a one-way process of continuous absorption, production and waste, the circular economy pays more attention to the circulation and application of resources in a cycle, shaping a self-recycling system to further ensure the overall sustainable evolution. Its core concept can be summarized into three basic principles, namely the "3R" principle: First, Reduce, by optimizing design, improving energy efficiency and changing consumption patterns, reduce the initial demand for resources. The second is Reuse, to extend the service life of the product, through maintenance, renovation and other ways to make the product multiple use. The third is Recycle, which converts waste into valuable resources and realizes the reuse of resources through recycling and recycling [3]. These three principles are interrelated and together form the basis of circular economy. Reduction reduces the initial demand for resources, reuse extends the life cycle of products, and resource reuse realizes the reuse of waste, forming a closed-loop resource flow system.

2.2. Application of circular economy in construction industry

There is a robust international framework of standards and certification, such as the LEED system - leading energy and environmental design excellence, and the BREEAM system - the building research institute environmental assessment instrument, all play a central role. These diverse evaluation practices are not limited to the energy efficiency and environmental impact of buildings, but place equal emphasis on the recycling of materials and sustainability goals [4,5]. Environmental considerations are given significant weight at the beginning of the design, advocating the use of eco-friendly materials in order to reduce resource consumption. The implementation of standardization and modular planning promotes the convenient disassembly and reuse of construction materials. During construction, environmentally friendly construction processes and facilities are promoted, which can reduce the loss of resources, optimize waste management, and improve resource utilization. In the period of operation and maintenance, intelligent building management systems to improve the energy efficiency of buildings has become the norm. The rainwater collection and reuse system is used to save water, and the loss of water resources is alleviated by the rainwater recovery system. The establishment of procedures for the separate collection and treatment of building waste has promoted the possibility of converting waste into resources. In addition, the easy disassembly of structural elements ensures the decomposition of the building and the reuse of materials. The materials thus disassembled are seamlessly integrated into the new construction plan, ensuring the life of the resource.

The Netherlands' De Ceuvel Innovation Park, located in the north of Amsterdam, consists of a cluster of 24 studio homes converted from old shipyards that demonstrate the true meaning of sustainable living models and circular economics. Each of the pontoon houses is constructed from recycled waste and is covered with solar panels, while a surface water resource management system is cleverly integrated. The community includes a biogas facility that effectively converts organic waste into renewable fuels. The purified rainwater is cleverly used to irrigate vegetation. In the De Ceuvel Innovation Park, residents and visitors work side by side, participate in the operation and maintenance of the community, and jointly push the boundaries of sustainable living. With its model characteristics of zero emissions and optimal use of resources, this unique community not only solidifies its role as a beacon of circular economy ideas, but also attracts many tourists and researchers to come and study. The Darmstadt-Kranichstein region in Germany witnessed the creation of the world's first passive house, which follows the high standards defined by the Passive House Institute. The building relies on its super-insulated wall and roof design, complemented by the clever application of triple glazing, to ensure a constant indoor climate. A set of advanced fresh air mechanism ensures natural ventilation and air quality, while eliminating moisture and harmful substances, maintaining a pure living environment. Photovoltaic installations on the roof provide some of the clean energy, while the ground source heat pump system takes care of both heating and cooling needs. The innovative Darmstadt-Kranichstein passive house, with its ultra-low energy consumption of only 15 KWH per square meter per year, dramatically reduces energy intake and significantly reduces environmental impact.

Located in the heart of the French capital, La Fabrique de La Biodiversite is a complex building that blends administrative offices, educational seminars and leisure Spaces to promote the philosophy of biodiversity conservation and the circular economy. The lush vegetation of the roof not only gives aesthetic value to the urban environment, but also creates an ecological oasis for birds and insects. Stormwater management systems ensure that precipitation is captured efficiently and reused to nourish vegetation and operate sanitation facilities. An in-house waste separation facility facilitates the orderly management of waste, which can be converted into fertile compost or renewable resources." "La Fabrique de La Biodiversite" has achieved an iconic change in the identity of the city of Paris by promoting environmentally friendly design and raising awareness of biodiversity and the circular economy.

3. CIRCULAR ECONOMY PRACTICE IN CONSTRUCTION INDUSTRY IN EUROPE

3.1. Policy environment

In 2015, the European Union launched the Circular Economy Action Plan (CEAP), whose core objective is to promote a smooth transition to a circular economy in all sectors, including the construction industry. This strategy involves systematic interventions across multiple sectors, such as by adapting and structuring regulatory frameworks such as the Construction Products Code (CPR) to enhance the ecological performance and resource productivity of construction products. In order to stimulate the adoption of circular economy models by businesses and individuals, economic incentives, such as financial subsidies and tax concessions, are on the agenda. At the same time, CEAP invests heavily in the research and development of circular economy technologies and innovations, hoping to improve resource utilization. It also advocates the establishment of a green procurement policy, urging the public sector to prioritize products with low environmental impact and low resource consumption. Member States have also introduced corresponding policies to support circular economy practices in the construction industry. Germany made the circular economy and waste management (Kreislaufwirtschaftsgesetz, stages - EG), requirements of construction waste recovery rate above 70%. The Dutch government has launched its "Circular Economy Action Plan 2050", which will reveal the position and expectations of the construction industry within the circular

economy system and promote the adoption of renewable and recyclable building materials. At the same time, the UK is actively advancing its ecological transformation agenda in the building sector through its building code framework and green building evaluation mechanisms such as BREEAM.

3.2. Face challenges

Although Europe has made remarkable achievements in the development of the circular economy in the construction industry, there are still several complex problems in the transition process. First of all, although technological progress and mechanical equipment innovation are crucial to the practice of circular economy model, they are hit by existing technical limitations and economic considerations. Secondly, the legal differences and coordination problems among member states and regions constitute obstacles to the large-scale promotion of circular economy. Moreover, consumers and the business community have a low degree of awareness and acceptance of the concept of circular economy, resulting in limited market demand. In addition, high start-up costs and long-term inability to return money quickly also discouraged investors. A range of responses to these challenges have been deployed across Europe. First, they have injected additional financial support into the research and development of circular economy-oriented technologies, further stimulating the innovation and application of advanced technologies. Second, they have succeeded in dismantling legal and regulatory barriers by building a unified regulatory mechanism and strengthening the coordination of policies across borders. There is also a desire across Europe to raise public awareness of the circular economy and encourage wider civic participation. Finally, public-private partnerships, green finance mechanisms and diversified investment sources are being actively explored to ease the financial pressure on projects and shorten the payback cycle.

4. CURRENT SITUATION AND DEVELOPMENT OF CIRCULAR ECONOMY IN CHINA'S CONSTRUCTION INDUSTRY

4.1. Policy support and market environment

The Chinese authorities have shown great importance to the sustainability and ecological evolution of the construction industry, and have therefore introduced a series of innovative policy initiatives, which can greatly promote the prosperity of the circular economy. This trend reached a significant inflection point in 2013, when the Green Building Action Plan issued by The State Council clearly set out such a vision. By 2020, more than half of new construction projects are expected to use green building technologies. As early as 2008, The State Council issued the Regulations on Building Energy Efficiency, which established the requirements for new structures to strictly comply with energy conservation standards, and drew blueprints for promoting energy efficiency upgrading of existing buildings. Then, in 2009, the Circular Economy Promotion Law adopted by the Standing Committee of the National People's Congress gave birth to the fervent advocacy of a circular economy model for the construction industry as a way to counter the excessive consumption of resources and the degradation of environmental protection. Moreover, in 2015, the Ministry of Housing and Urban-Rural Development and the Ministry of Industry and Information Technology jointly formulated the "Management Measures for the Evaluation and Identification of Green Building Materials", which greatly promoted the production and use of green building materials. Under the influence of these policies and the increasingly mature market, China's construction industry has seen gratifying progress in the practice of circular economy. It is manifested in. First, the demand for green buildings and circular economy products spawned by the promotion of public environmental protection concepts is growing, indicating the vast market potential. The second is the technological innovation achieved by the industry in green building materials, energy efficiency improvement and waste management, which become the scientific and technological cornerstone of the circular economy. Moreover, many enterprises have recognized the synergies between the upstream and downstream of

the supply chain, and improved the operational efficiency of the entire industry through resource sharing and recycling.

4.2. Practical exploration

Located in the bustling city of Shanghai, China, its landmark building - Shanghai Tower, with an elevation of 632 meters and a total floor area of 380,000 square meters, is a model of green architecture, demonstrating the implementation of the concept of circular economy and sustainable development. Eco-friendly materials such as advanced high-performance concrete and energy-saving glass are used in the building to minimize resource loss and ecological load. The tower's distinctive double-curtain wall system helps manage indoor climate, further reducing energy consumption for air conditioning and lighting. The configuration of solar photovoltaic arrays injects renewable energy into the building to meet some of the electricity needs. In addition, the building is also equipped with a rainwater collection and reuse mechanism, and the purified rainwater is widely used in vegetation conservation and irrigation and water replenishment activities of the cooling tower. At the same time, innovative strategies for waste sorting and management have been introduced, further demonstrating its role as a model for recycling by cleverly treating and reusing waste as road paving and filling materials. The landmark building of Shanghai - Shanghai Tower, with its outstanding architectural art concept and outstanding optimal use of resources, has not only established an unparalleled model status in China's green building industry, but also become an environmentally friendly landmark, carrying an epoch-making ecological transformation symbol.

Located in the Olympic Park in the heart of Beijing, the world-famous National Stadium, commonly known as the "Bird's Nest", was a unique architectural design that won the status of the main event venue during the 2008 Summer Olympic Games, with a massive floor area of 258,000 square meters. In the whole process of conception and construction, the designers cleverly integrated the forward-looking thinking of circular economy. A delicate combination of steel and membrane material is chosen for the main structure to minimize the consumption of building materials. Its architectural form subtly echoes the biological inspiration of bird nesting, subtly strengthening the stability and aesthetic quality of the structure. At the same time, the design also includes rainwater collection and reuse mechanism, through the delicate water treatment process, rainwater can be used to provide water for green irrigation and sanitation facilities. In addition, the marriage of energy efficient lighting equipment and intelligent control system reduces unnecessary energy consumption. The configuration of solar photovoltaic panels meets part of the electricity needs. Even more noteworthy are the innovative practices of waste management programs, which turn waste into a valuable source of road paving and filling materials through waste sorting and treatment. Therefore, the "Bird's Nest" not only reached the peak of architectural art, but also played an exemplary role in the sustainable use of resources and ecological environmental protection, thus becoming a landmark masterpiece of green architecture in China.

4.3. Comparative analysis with Europe

China: Policy support is relatively comprehensive, but there are differences in policy implementation intensity and local implementation. The implementation rules of some local policies are not specific enough, which affects the effect of the policies. Technological progress is rapid, but there are still shortcomings in some key technical areas, such as high-performance building materials and intelligent management systems. In addition, the popularization and application of technology need to be improved. The public's awareness and acceptance of circular economy is gradually improving, but there is still a certain gap. There is room for further publicity and education by the government and industry in order to raise public awareness of environmental protection.

Europe: The policy system is relatively perfect, there is a better coordination mechanism between the EU and the member states, and the policy implementation is strong. For example, Germany's Circular

Economy and Waste Management Act and the Netherlands' Circular Economy 2050 Strategy both provide clear guidance and support for a circular economy in the construction sector. The application of technology is more mature, especially in green building materials, energy efficiency improvement and waste treatment. For example, the De Ceuvel Creative Village in the Netherlands and the Darmstadt-Kranichstein passive House in Germany both employ advanced circular economy technologies. The society has higher cognition and acceptance of circular economy, and the public participation is strong. For example, the community participation model in the Netherlands and the public education campaign in France have both effectively promoted the development of the circular economy.

5. SPATIAL PLANNING STRATEGY BASED ON CIRCULAR ECONOMY

5.1. Construction of theoretical framework

Circular economy emphasizes efficient use of resources and minimization of waste, forming a closed-loop system through design, production, recycling, reuse and other links. Spatial planning is to optimize the function and structure of cities and regions through the rational layout of land use, transportation networks and public service facilities.Infiltration of the essence of renewable circulation into regional planning practice can maximize the delicate turnover of resources, reduce the pressure on the ecological environment, and further consolidate the sustainable development potential of the city. This will also enhance people's life satisfaction and happiness, which is conducive to social stability and prosperity. Referring to the principle framework of circular economy and the vision of spatial planning, this paper puts forward a set of customized spatial planning strategies for the construction industry, the core elements of which include. Scientific allocation of various types of land use in order to stimulate the optimal use of resources. At the same time, we advocate lean design of transportation systems to ease traffic congestion, with the goal of reducing energy consumption in order to reduce unnecessary energy loss.We will improve public service facilities and improve residents' quality of life. Promote green buildings to achieve energy efficiency and resource recycling. Establish a classification collection and treatment system for construction waste to realize the reuse of resources. Encourage community residents to participate in the practice of circular economy and raise public awareness of environmental protection.

5.2. Concrete measures and suggestions

Promote diversified land use strategies, and advocate the integration of residential, commercial and administrative functions in the setting of areas to improve the efficiency of territorial space operation. It is hoped that the urban green lung can be maintained and expanded, which can provide ecosystem benefits while improving the quality of life of citizens. In order to improve the urban style and enhance its comprehensive performance, we should carry out the renovation of the old urban area and uphold the forward-looking thinking of green construction and circular economy. At the same time, the public transport system needs to be carefully optimized to ensure that its accessibility and ride comfort are upgraded to curb the dependence of individual vehicles.The construction of sound walking and cycling paths encourages residents to choose green travel. Intelligent traffic management system is introduced to improve the operating efficiency of the traffic system. Build a community integrated service center to facilitate people to handle daily business. The construction of neighborhood parks and recreation facilities can create a public space for residents to enjoy themselves. A balanced arrangement of institutions of learning and education so as to fully respond to the thirst for knowledge of the population. To uphold the principles of ecological design, to reshape the form and utility of architectural design, with a view to striking a balance between the consumption of natural resources and the reduction of environmental load. Promote the use of green building materials, which can enhance the sustainable performance of buildings and reduce their environmental impact. Adopt advanced energy saving technologies to reduce the energy consumption

of buildings. Set up rainwater collection and reclaimed water reuse mechanisms to ensure proper management of water resources and improve water efficiency. The implementation of a waste separation and recycling system, which can convert waste into renewable resources, such as road paving or landfill materials, further promote the goal of material recycling. Through a variety of publicity and education measures, to enhance residents' awareness and sense of participation in environmental protection. Organize community volunteer teams to participate in environmental protection activities. Establish a feedback mechanism for residents to improve community management and services. Laws and regulations specifically aimed at circular economy and green buildings have been introduced to provide legal protection for relevant work. Establish a comprehensive circular economy and green building standards system, in order to achieve the standardization and systematization of work processes. At the same time, efforts should be made to strengthen the support for green technology research and development, and promote technological innovation and practical application. In addition, it is crucial to expand cross-border dialogue and collaboration, drawing on the proven practices of advanced countries such as Europe, in order to drive the sustainable evolution of the global construction industry. To promote multiple land use planning strategies, integrating residential, commercial and office space to further maximize the use of land resources. Planting green and maintaining urban green space can improve the quality of ecological and environmental services and enhance the life satisfaction of citizens. The implementation of the old urban renewal, the use of green building principles and the concept of circulation, can glow the dual upgrade of urban aesthetics and functions. By adjusting the public transport architecture to enhance its accessibility and comfort, it is expected to curb the excessive growth of individual vehicles. Build the completeness of walking and cycling routes to encourage residents to adopt low-carbon travel methods. Intelligent traffic control system is introduced to improve the operation efficiency of the entire traffic network. Establish a community integrated service hub to simplify the process of residents' daily affairs. Create neighborhood parks and leisure Settings, and create rich public leisure Spaces. According to the principles of ecological planning, the structure and utility of the building are adjusted to reduce energy waste and environmental burden. Vigorously promote the use of environmentally friendly building materials to enhance the green properties of buildings. Use high efficiency and energy saving technology to reduce the energy consumption of buildings. Set up rainwater collection and reclaimed water reuse systems to improve the efficiency of water resources. Establish a classification and collection system for construction waste to transform waste into valuable resources, such as road paving materials, landfill materials, etc., to realize the recycling of resources. Through various forms of publicity and education activities, to improve residents' environmental awareness and participation. Organize community volunteer teams to participate in environmental protection activities. Establish a feedback mechanism for residents to improve community management and services. Laws and regulations specifically aimed at circular economy and green buildings have been introduced to provide legal protection for relevant work. Formulate and improve the relevant standards and norms of circular economy and green building to ensure the standardization and standardization of all work. At the same time, we should strengthen the capital support for the research of circular economy and ecological building technology, so as to promote the joint development of scientific and technological innovation and practical application. Moreover, it is important to strengthen transnational interaction and collaboration, and lead the environmental transformation of the world's construction industry through learning and introducing advanced countries and regions such as Europe and their accumulated mature practical experience.

6. CONCLUSION

From the perspective of circular economy, this paper discusses the spatial planning strategy of closed-loop utilization of resources in construction industry. By analyzing the practical experience of Europe and China, this paper constructs a set of spatial planning strategy system suitable for the construction industry, and puts forward the concrete implementation mechanism. It is hoped that this study can

provide useful reference for relevant policy formulation and practical operation, promote the sustainable development of the construction industry, and contribute to the realization of global sustainable development goals.

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