CIRCULAR ECONOMY IN CONSTRUCTION PROJECTS IN VIETNAM: POLICY CONTEXT, CURRENT PRACTICES, AND RESEARCH GAPS

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Abstract - The construction sector is a major consumer of natural resources and a significant source of emissions, making the transition toward a circular economy (CE) essential for sustainable development. Although Vietnam has introduced key policy commitments, including the Green Growth Strategy 2021–2030 and the Net Zero target by 2050, the implementation of CE principles in construction projects remains fragmented and lacks a unified assessment framework. This paper reviews the theoretical foundations of CE in the construction sector and examines the current state of application in Vietnam through literature review, policy analysis, and expert consultation. The findings indicate that existing practices mainly focus on waste management and recycled materials, while life-cycle-based design, supply chain integration, and governance mechanisms are insufficiently addressed. The study identifies critical research and practical gaps, providing a foundation for developing quantitative indicators and an assessment framework for CE implementation in construction projects in Vietnam.

Key words - Circular economy; Construction industry; Sustainable development; Environmental policy; Vietnam.

1. Introduction

The construction industry plays a key role in socio-economic development but is also a sector that consumes a large amount of resources and generates significant emissions.

According to a report by the United Nations Environment Programme, the construction and operation sector uses about 37% of total energy-related CO_2 emissions and more than 30% of total natural resource consumption [1]. The traditional linear development model “extraction – production – use – disposal” is putting increasing pressure on the environment, especially in the context of climate change, resource depletion and the need to transition to a carbon economy. International studies indicate that carbon emissions from materials and construction processes account for a large proportion of total lifecycle emissions [2]. This adjustment shows that focusing only on reducing operational emissions is insufficient; a comprehensive lifecycle approach is needed.

Circular economy (CE) is considered an alternative model to the linear economic communication system, aiming to maintain material value for as long as possible. In the construction industry, CE includes designs for storage, reuse of components, optimization of lifecycle and reduction of carbon emissions [3], [4]. For investment construction projects, CE is not only an environmental solution but also a tool to improve economic efficiency and long-term sustainability of the process.

In Vietnam, rapid urbanization, especially in coastal cities such as Nha Trang, Da Nang, and Quy Nhon, is putting great pressure on the ecosystem and construction resources. Integrating CE into construction project management will become a requirement to provide policy and practical equipment, at the 2021 United Nations Summit (COP26), Prime Minister Pham Minh Chinh announced a commitment to responding to climate change. The goal is to reduce total national emissions by 43.5% by 2030 and achieve carbon neutrality by 2050; and to reduce emissions by at least 30% by 2030 compared to 2020 emission levels [5]- [7]. However, the development of the CE in construction still lacks measurement tools and a unified pricing framework.

2. Research methods

This study employs a qualitative approach, combining:

(i) a systematic literature review;

(ii) policy content analysis;

(iii) a comparison of international assessment models to build a theoretical framework and identify research gaps on CE in the Vietnamese construction industry.

The literature review was conducted on international and Vietnamese databases, focusing on CE, circularity indicators, life cycle assessment (LCA), carbon emission reduction, and multi-criteria decision-making (MCDM).

Policy analysis was applied to key legal documents such as the 2020 Environmental Protection Law, Decree 08/2022/ND-CP, and Decision 687/QD-TTg to assess the level of CI integration and implementation mechanisms.

Based on that, the study conducts a comprehensive analysis to identify gaps and propose a theoretical framework for evaluating the feasibility of construction in a manner suitable to the Vietnamese context.

3. Theoretical foundation of CE assessment in construction

3.1. Composite Index Approach

The CCI (Circular Construction Index) by Anastasiades et al. is a construction completion index based on the 4R rule (Reduce, Reuse, Recycle, Restore), measuring the ability to minimize the use of primary resources, reuse configurations, recycle materials, and recover valuable materials throughout the process [2]. The study emphasizes the role of early design research in improving work completion efficiency. CCI not only considers the regeneration rate of materials but also assesses the ability to minimize the use of primary resources, the potential use of the structure, and the level of material value recovery after rescue. In addition, the study emphasizes the crucial role of the initial design phase; integrating circular thinking from the design stage is considered a factor that subsequently promotes overall circular efficiency and optimizes resource utilization throughout the building's lifecycle.

3.2. A whole-lifecycle approach to construction projects.

Khadim et al.'s WBCI (Whole Building Circularity Indicator) is an indicator for assessing circularity at the whole building level, integrating the LCA method with a comprehensive index system to analyze resource utilization efficiency, material flow, and environmental impact throughout the building's lifecycle [8]. This study applies to a case study to illustrate the feasibility of evaluating the assessment framework. This framework not only considers input and output material flows but also analyzes environmental impacts throughout the life cycle, from material extraction, construction, operation to the end-of-use phase. By combining the completion circular index with LCA results, WBCI assesses simultaneous resource efficiency, environmental performance, and the study provides a comprehensive view of the feasibility of implementing CE in construction.

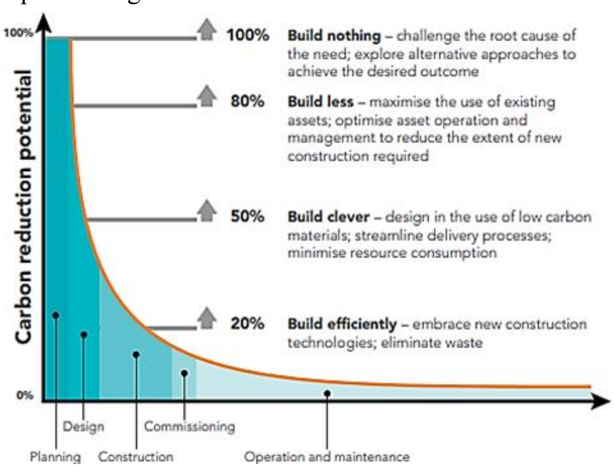

Figure 1. *Embodied carbon reduction potential at different stages of a building project [9]*

Recent studies show that the highest carbon emission reduction potential occurs during the planning and design phases, then decreases during the construction, operation, and maintenance phases. Strategies are categorized by impact level, including: "Build nothing" (avoiding the need for new construction), "Build less" (optimizing existing assets), "Build clever" (designing using low-carbon materials), and "Build efficiently" (improving construction efficiency and reducing waste). This result highlights the crucial role of the design phase in controlling carbon encapsulation and guiding emission reductions throughout the building's lifecycle. [9]

3.3. Multi-criteria approach to decision-making

Meng et al. [10] developed a multi-criteria decision-making model considering uncertainty (probabilistic MCDM) to evaluate the cyclical performance of modern construction products. This research model allows for the integration of performance analyses of evaluation criteria prices, thereby better reflecting the level of uncertainty in the data and improving the reliability of the weekend method ranking results.

Kung [4] used the QFD–TOPSIS method, which combines QFD to transform stakeholder requirements into technical criteria and TOPSIS to classify methods, thereby supporting the selection of optimal solutions oriented towards weekly completion. Decision support in home projects. Rational method. And proposed a model support for rational decision-making QFD–TOPSIS to evaluate and select cyclical economic strategies for completion in housing projects.

These studies [2], [4], [8], [10] affirm that CE assessment should not only focus on environmental measurement but also integrate economic and managerial factors, showing that the trend of CE assessment in construction is shifting towards multi-criteria integrated quantitative models and lifecycle analysis. These works emphasize the combination of decision-making tools (MCDM, QFD–TOPSIS) with lifecycle assessment indices (LCA, CCI, WBCI) and affirm the key role of the early design phase in optimizing the circular performance and resource efficiency of the building.

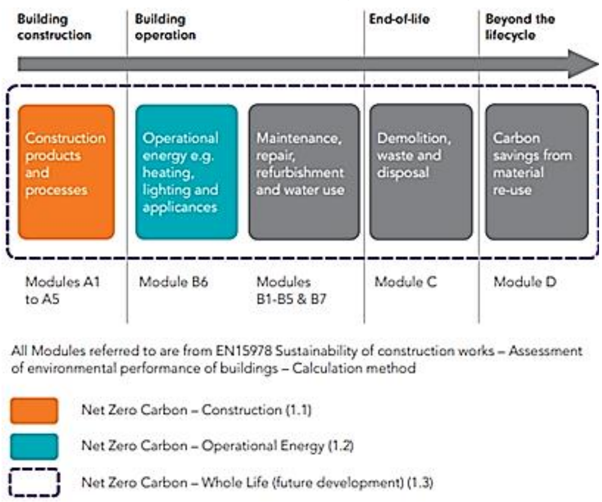

Figure 2. *Breakdown of three net zero carbon scopes [9]*

In addition, the BS EN 15978:2011 standard divides the carbon emission cycle of a building's life cycle into modules, including contain carbon (A1–A5, B1–B5, C, D) and operating carbon (B6–B7). Currently, countries mainly focus on reducing emissions in the pre-operation phase (A1–A5) and operating energy (B6) [9]. In this direction, the UK Green Building Council (UKGBC) has proposed presenting emission reduction procedures for the two phases above, while aiming for a whole-cycle carbon assessment. This approach creates a reasonable CE and LCA methodology into the system for evaluating the effectiveness of construction projects according to the Sustainable Guidance Firmware.

4. Framework for CE policy in Viet Nam

The legal framework for the CE in Vietnam is formed on the basis of synchronization between laws, decrees, and the national strategy on sustainable development. The most important foundation is the Law on Environmental Protection, in which Article 142 for the first time officially defines and institutionalizes the concept of CE in the national legal system. According to this regulation, CE is an economic model in which design, production, consumption, and service activities aim to reduce resource exploitation, extend product lifecycles, limit waste generation, and enhance reuse and recycling [11]. Legalizing this content marks a shift from the approach of “waste management” to “resource lifecycle management”.

To concretize the Law, the Government issued Decree 08/2022/ND-CP, detailing some articles of the Law on Environmental Protection, including content related to the organization of CE implementation, responsibilities of state management agencies and participating entities [12]. This Decree provides a legal basis for the development of circular models in production and services.

At the strategic orientation level, Decision 687/QD-TTg dated June 7, 2022, approving the Vietnam Circular Economy Development Project, is a document establishing the CE as an official development model in the national economic-environmental policy system [13]. The topic emphasizes the need to shift from the mindset of "end-of-pipe waste treatment" to "resource lifecycle management," providing a comprehensive circular principle into the process of policy building and production-consumption organization.

Simultaneously, Decision 1658/QD-TTg approving the National Strategy on Green Growth for the period 2021-2030, with a vision to 2050, has identified green growth and efficient resource use as a consistent orientation in socio-economic development [14]. These targets are consistent with Vietnam's commitment to achieving net zero emissions by 2050.

Furthermore, Decree No. 29/2026/ND-CP dated January 19, 2026 [15], on domestic asset exchange is considered one of the key policies for developing a CE in large-scale construction. This decree provides a legal basis for the formation and operation of a quality product market, encouraging construction enterprises to reduce greenhouse gas emissions, use resources efficiently, enhance material recycling, and apply low-carbon technology solutions consistent with the principles of sustainable development and Net Zero.

In parallel, Article 11 of Law No. 135/2025/QH15, dated December 10, 2025, effective from July 1, 2026 [16] encourages the development of green buildings and the use of environmentally friendly materials, improving energy and resource efficiency, as well as providing digital transformation and the development of smart, green and climate-resilient cities.

Although the policy framework at the model level is relatively complete, the construction sector of the CE still lacks guidance techniques and assessment tools at the project and construction levels. There is currently no precise quantifier to measure the level of completion in the design, construction, and lifecycle management phases. This gap is considered necessary to develop assessment tools suitable for the context of the specialized construction sector in Vietnam.

5. Current status of implementation in Viet Nam

Currently, CE activities in the construction sector in Vietnam mainly focus on: (i) recycling and reusing construction waste; (ii) developing and using non-fired building materials to reduce resource exploitation and emissions; and (iii) improving building energy efficiency through the application of technical standards and energy-saving solutions. However, these activities are still mainly isolated technical initiatives and have not yet formed a comprehensive CE at the project level and within the construction value chain.

According to Finamore's overview [17], studies on the CE in construction often focus on waste and material management, while the integrated governance and supply chain aspects are limited. The situation in Vietnam shows a similar trend. Nguyen et al. [18] analyzed the possibility of achieving Net Zero in the construction sector in Vietnam through the AHP and DEMATEL methods, indicating that it is necessary to simultaneously improve policy mechanisms, technology and assessment tools.

In addition, research on implementation barriers identified four main barriers when implementing the CE in construction in Vietnam: (i) lack of infrastructure for material collection and recycling; (ii) limited awareness and commitment of enterprises; (iii) lack of mandatory legal and policy framework; (iv) limitations in technology and quality standards of reusable materials [19]. It is necessary to improve policies, green finance mechanisms and enhance technical capacity to promote the CE in the construction industry. Research assesses the current state of CE application in material production, pointing out limitations in policy, technology, management and financial mechanisms. At the same time, the author proposes several synchronized solutions, including improving the legal framework, enhancing recycling technology, financial mechanisms and a roadmap for implementation in the 2025-2030 period to promote the CE and contribute to sustainable development [20]. Another study also points out the barriers to the application of the CE in the Vietnamese construction industry: ineffective policies, cooperation between parties, limited awareness of the CE. The study shows that the complexity of materials and construction structures is the root cause affecting other barriers. These findings help provide a scientific basis for policy planning and strategies to promote the CE in construction in Vietnam [21].

Son et al. [22] employed the LCA method to evaluate greenhouse gas emissions across the entire building life cycle and proposed using LCA as a standard basis for environmental assessment aimed at achieving carbon neutrality. Drawing on data from 72 housing samples from the IMPRO-Building project, the study revealed that high-rise buildings are more energy-efficient than low-rise ones, while cold climatic conditions significantly increase energy demand. The findings also highlight the role of LCA in reducing carbon emissions and promoting sustainable development within the construction industry.

The aforementioned domestic studies have identified the main barriers: Lack of infrastructure for material collection and recycling; Limited awareness and commitment from businesses; Lack of mandatory policy mechanisms and quantitative tools; Limitations in technology and quality standards for reusable materials; The complexity of materials and building structures makes dismantling and reuse difficult. These barriers reveal a clear gap in the integrated CE assessment framework at the construction project level, especially in the current context where Vietnam is aiming for Net Zero and sustainable development in the future. On the other hand, current policies are only at the macro-level of guidance and have not yet been transformed into practical management tools. This also provides the scientific basis for developing a set of criteria for evaluating the effectiveness of construction projects in a CE direction in subsequent studies.

6. Comparing international models

CE studies in construction (Figure 3) show a trend shifting from conceptual approaches to multi-criteria quantitative models and lifecycle integration. At the sectoral level, projects primarily build index-based frameworks; at the project and construction levels, models such as CCI, Whole-building circularity, and MCDM support more effective evaluation and decision-making. However, much of the research still relies on big data, expert assessments, and has not fully integrated economic, environmental, and managerial aspects into a comprehensive evaluation framework, particularly suitable for the context of developing countries.

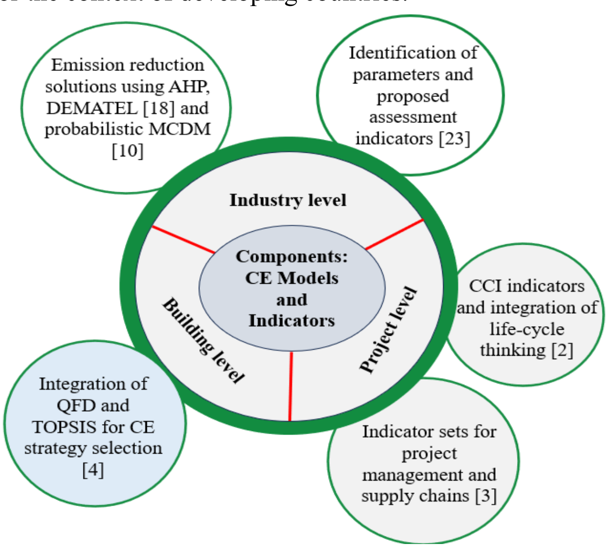

Figure 3. *Analyzing CE models in the construction industry: from industry level to project level studies. (Source: Compiled by the author from various sources)*

Sector-level models focus on systematizing material, energy, and emission flows, building a relatively complete theoretical foundation but lacking quantitative models and empirical validation. Project-level models emphasize the integration of CE into management and supply chains, with a clear index structure, but have not fully integrated LCA and are limited in multi-context validation (Figure 4).

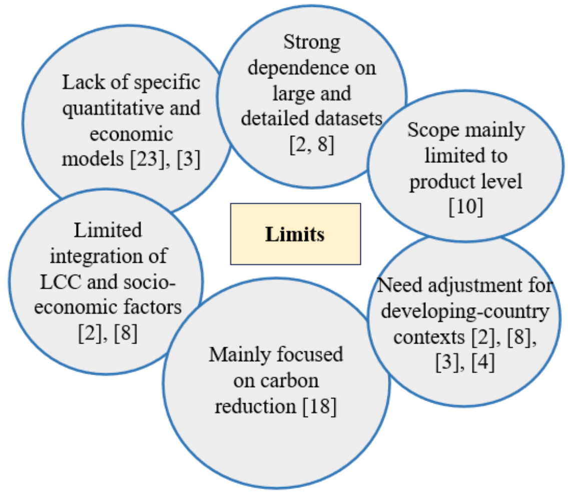

Figure 4. *Limitations of the studies (Source: Compiled by the author from various sources)*

Studies have revealed several outstanding strengths in evaluating the CE in the construction industry. Firstly, these studies have developed a relatively clear and comprehensive system of indicators, providing an important theoretical foundation for assessing the circularity of construction projects. Secondly, the integration of lifecycle thinking (LCA) expands the scope of evaluation from the design phase to operation and decommissioning. Some studies also effectively support the design and decision-making process through multi-criteria models such as AHP, DEMATEL, and TOPSIS. Importantly, many models have been adapted to the practical conditions of developing countries, contributing to improved feasibility and applicability in construction practice (Figure 5).

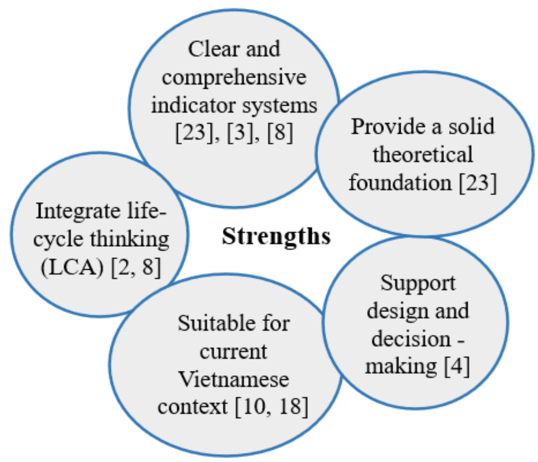

Figure 5. *Strengths of the research (Source: Compiled by the author from various sources)*

Construction-level models such as CCI and composite material-based indices represent significant progress in integrating life cycle thinking and quantitative analysis. However, they rely heavily on detailed material data and have not deeply integrated socio-economic factors (LCC).

Meanwhile, MCDM methods (AHP, DEMATEL, TOPSIS, probabilistic MCDM) support effective decision-making and uncertainty management, but mainly focus on strategic ranking rather than building a comprehensive circular measurement system.

Overall, a prominent gap is the lack of an integrated framework that simultaneously combines LCA, circularity indicators, and MCDM at the project level, suitable for the context of developing countries.

7. Research gap

From the above analysis, three main research gaps can be identified:

a. Lack of an integrated set of indicators suitable for assessing the CE in the Vietnamese context, taking into account Vietnam's technical, legal, and market conditions;

b. Lack of data for LCA, especially data on materials, emissions, and domestic construction waste flows;

c. Failure to integrate circularity into construction project management from the investment preparation phase to operation and completion of the project's life cycle.

The international studies analyzed above have provided an important methodological foundation for building indicators and assessment models. Their application in Vietnam requires adjustments to suit the institutional context, implementation capacity, and characteristics of the domestic construction market.

8. Orientation for developing the index system

Based on a synthesis of internationally validated studies published in reputable journals, a framework for developing a circularity assessment system in construction can be proposed, consisting of four main groups:

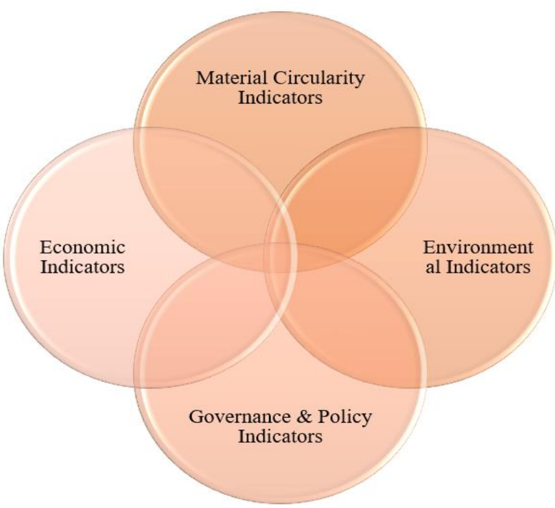

Figure 6. *The study proposes four main sets of indicators to assess circularity in the construction industry*

(1) Material Circularity Indicators

Focusing on resource utilization efficiency and material life cycle, including: reuse rate, recycling rate, recycled material content, dismantling and material recovery capabilities [2], [3].

(2) Environmental Indicators

Assessing environmental impact throughout the entire life cycle of a construction project through the LCA method, especially greenhouse gas emissions, embodied carbon, and energy consumption [3].

(3) Economic Indicators

Reflects investment efficiency towards sustainability, including life cycle cost (LCC), material recovery value, and long-term financial efficiency of the CE strategy [8], [10].

(4) Governance & Policy Indicators

Assesses the level of integration of policy mechanisms, project management capacity, legal framework supporting the CE, and coordination among stakeholders [4], [17].

International studies have provided an important methodological foundation for building indicators and evaluation models. However, application in Vietnam requires adjustment according to the institutional context, implementation capacity, and domestic data conditions.

9. Conclude

This study systematizes the theoretical foundation of the CE by building upon international literature, analyzing the current policy framework in Vietnam, and identifying key research gaps.

The results show that Vietnam has initially laid the legal foundation for the transition to a CE through the 2020 Environmental Protection Law, Decree 08/2022/ND-CP, and green growth and Net Zero strategies. However, the application of the CE in current construction projects still mainly focuses on waste recycling, construction materials, and energy saving, and has not yet formed a rational analytical approach according to the building lifecycle.

The study also points out the main gaps, including: a lack of a CE assessment indicator system suitable for the Vietnamese context; a lack of a database for assessing the work lifecycle; and insufficient integration of assessment tools into construction project management. In addition, policy, technology, capacity management, and coordination among stakeholders remain major obstacles to the successful transition to a circular construction model.

Based on this, the study identified three key research gaps: (i) a lack of a suitable set of CE assessment indicators for the technical, legal, and data conditions in Vietnam; (ii) a lack of integration between LCA, circularity indicators, and multi-criteria decision support methods; and (iii) the failure to integrate CE thinking into the entire construction project management process from the investment preparation phase to operation and completion of the project's life cycle.

Based on the analysis results, the study proposes directions for developing a system of CE assessment indicators in construction according to four main groups: material indicators, environmental indicators, economic indicators, and governance-policy indicators. This is considered the initial foundation for building an integrated CE assessment framework in construction projects in Vietnam, contributing to supporting decision-making, improving resource efficiency, reducing carbon emissions, and promoting the transition to a sustainable construction industry towards the Net Zero target by 2050.

Developing a rational integrated circular indicator system – based on internationally proven methodologies and adapted to Vietnam's institutional, technical, and market conditions – is a crucial research direction for the next phase. This framework will contribute to improving the functionality of measurement, supporting decision-making at the project level, and promoting the transition to large-scale circular construction projects.

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