CONFIGURATIONS OF FINANCIAL INDICATORS AND CIRCULAR ECONOMY ENGAGEMENT: IMPLICATIONS FOR GROSS MARGIN IN THE TRANSPORTATION INFRASTRUCTURE CONSTRUCTION- EVIDENCE FROM FSQCA

Nguyen Thi Thuy Dung[1,*], Bui Minh Chau[2], Dao Ngoc Mai Phuong[3], Mac Lien Cuong[4]

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ABSTRACT

This study investigates the relationship between financial indicators and circular economy participation (CES) in listed transportation construction companies in Vietnam during 2020 - 2024, with a particular focus on gross profit margin (GM). The dataset consists of 20 listed firms, yielding 100 firm-year observations, which allows the analysis to capture sector-specific characteristics while reflecting the limitations of a relatively small sample size. Using the fuzzy-set qualitative comparative analysis (fsQCA) method, the research explores how different configurations of debt ratio (DTA), total asset turnover (TAT), fixed asset ratio (FAT), and current ratio (CR) interact with CES to shape profitability outcomes(GM). Descriptive statistics reveal that CES remains at a relatively low level across the sample, while GM exhibits significant variation, ranging from negative to positive. The results indicate that CES alone does not guarantee high profitability; however, when combined with favorable financial structures such as efficient asset utilization, strong liquidity, or balanced fixed asset investments CES becomes a critical catalyst for improving GM. Conversely, in cases of weak financial management, CES tends to be symbolic and fails to contribute to profitability. The findings highlight the asymmetric role of CES in shaping financial performance and provide practical implications for integrating circular economy practices with financial strategies to enhance sustainable value creation in transportation construction enterprises.

Keywords: *Circular economy (CES); Gross margin (GM); Financial configurations; Transportation infrastructure; fsQCA.*

[1]Department of Transport Economics, Faculty of Transport - Economics, University of Transport and Communications, Hanoi, Vietnam
[2]11th Grade Student, Class 11B2, Vinschool The Harmony High School, Hanoi, Vietnam
[3]Undergraduate Student, Department of Electrical and Computer Engineering, School of Engineering, Tufts University, Massachusetts, United States
[4]Undergraduate Student, Department of Transport Economics, Faculty of Transport - Economics, University of Transport and Communications, Hanoi, Vietnam.
[*]Email: dungntt89@utc.edu.vn
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1. INTRODUCTION

The construction of transportation infrastructure has long been recognized as a foundation for economic growth and connectivity. However, this sector also ranks among the most environmentally intensive industries, contributing substantially to greenhouse gas emissions, resource depletion, and construction and demolition waste [1].

According to international assessments, transportation construction activities including material production, heavy machinery operation, and large-scale excavation account for a significant share of environmental externalities, posing challenges to both ecological sustainability and human health [2].

Against this backdrop, the circular economy (CE) model has emerged as a promising framework to reconcile economic efficiency with environmental responsibility. By emphasizing resource efficiency, recycling, and carbon reduction, CE participation (CES) has been promoted as a priority pathway for sustainable infrastructure development worldwide [3].

Despite growing interest in CE practices, a persistent debate concerns whether these initiatives translate into tangible financial benefits for construction companies. In theory, adopting green standards, using recycled materials, and integrating life-cycle assessment can enhance long-term competitiveness, reduce operational risks, and build stakeholder trust [4].

Yet, in practice, firms often face high upfront costs, limited financial incentives, and regulatory uncertainties [5].

For transportation construction enterprises in emerging economies like Vietnam, the situation is particularly complex: projects are highly capital intensive, dependent on debt financing, and vulnerable to liquidity constraints. In such a context, profitability especially measured through gross profit margin (GM) becomes a critical benchmark. GM not only reflects how effectively companies control costs relative to revenues but also indicates whether CE practices can generate economic returns rather than remain symbolic commitments [6].

The financial literature has traditionally emphasized the role of debt management, liquidity, and asset utilization in shaping profitability. Studies show that high leverage may erode margins due to rising interest expenses, while efficient asset turnover and strong liquidity can enhance financial resilience. However, there is limited empirical evidence on how these financial indicators interact with CE adoption in the construction industry. Existing research has either focused on the technical aspects of CE implementation or on conventional financial determinants of profitability, leaving a gap in understanding the integrated effects of both domains. This gap is especially salient in the transportation construction sector, where firms must simultaneously pursue financial stability and sustainability objectives under competitive and policy-driven pressures [7].

Addressing this gap, the present study investigates the causal configurations of financial indicators and CE participation that lead to high or low GM outcomes among listed transportation construction companies in Vietnam between 2020 and 2024. By applying fuzzy-set qualitative comparative analysis (fsQCA), the research moves beyond single-variable effects and captures the complex, asymmetric relationships between financial structures and sustainability practices. This approach makes it possible to identify multiple pathways: for example, high CES combined with efficient asset utilization may drive profitability, while in other cases, strong liquidity can offset weak CE adoption.

The contribution of this study lies in three main areas. First, it enriches the literature on sustainable construction finance by integrating CE participation into profitability analysis, a link that remains underexplored. Second, it provides empirical evidence from Vietnam, a developing country context where transportation infrastructure investment is critical yet constrained by financial and environmental challenges. Third, it offers practical implications for managers and policymakers, showing how aligning CE initiatives with financial strategies can create both economic and environmental value. Ultimately, the findings aim to inform decision-making in transportation construction enterprises, highlighting conditions under which CE adoption becomes a driver of profitability rather than a financial burden.

2. THEORETICAL BACKGROUND

2.1. Financial Indicators and Circular Economy Adoption Affecting the Performance of Transportation Infrastructure Construction

In the transportation infrastructure construction (TIC) sector, the adoption of circular economy (CE) practices is increasingly becoming a decisive factor for enhancing business performance. Edalatpour, Al-e-Hashem, and Ghasemi developed a mathematical model integrating project management with supply chain systems to optimize resource allocation, reduce emissions, and balance profitability with costs in volatile economic contexts [8]. Their findings indicate that when firms embed CE principles into project management, they not only reduce environmental costs but also improve financial stability and long-term profitability. From a project governance perspective, Arabpour and Silvius emphasized the role of sustainable managerial interventions particularly in communication, regulation, and supply chains [9]. Such measures create a “minimum sustainability baseline” that enables TIC enterprises to implement CE without disrupting operational efficiency. This suggests that sustainability and profitability are not mutually exclusive but can be mutually reinforcing if properly integrated.

Thus, CE delivers not only environmental benefits but also contributes to business performance, particularly in transportation construction - an industry characterized by high material costs and substantial environmental impacts.

Given that the construction sector faces high financial costs and inherent risks, the gross profit margin (GM) directly reflects a firm's capacity to create value after accounting for material and production expenses.

Au and Hendrickson found that firms with high financial costs were unable to achieve strong business performance when the economy was volatile [10]. Similarly, Wibowo et al. showed in the Indonesian context that state-owned construction companies, despite having greater access to debt financing, generated lower economic efficiency compared to their private-sector counterparts [11].

From a liquidity perspective, Zimon et al. analyzing construction companies in Poland, revealed an inverse relationship between liquidity and profitability [12]. This finding is reinforced by the review of Puican Rodriguez et al., which shows that the liquidity-profitability relationship varies across industries, with construction being especially sensitive to working capital and cash flow risks [7].

Asset utilization efficiency has also been identified as a crucial determinant. Kumar and Manjunatha confirmed that asset turnover and working capital relative to total assets directly affect the financial performance of Indian construction firms [13]. Enqvist et al. further noted that this effect becomes stronger during downturns, where working capital management determines a firm's ability to sustain profitability [6]. Banerjee and Deb added that strong managerial ability helps balance capital expenditure (CAPEX) and working capital, thereby optimizing GM [14].

The most recent study by Oblouková et al., covering nearly 10,000 construction firms in four Visegrad countries, demonstrated that the debt-to-assets ratio and asset turnover are positively associated with profitability, underscoring the critical role of financial management in the construction industry [15].

Taken together, these studies suggest that the GM of TIC enterprises is directly shaped by three key groups of financial indicators: (i) debt structure, (ii) liquidity, and (iii) asset utilization efficiency (such as asset turnover, fixed asset ratio). When combined with CE adoption, these factors become even more significant, as the costs of recycled materials, green financing, and energy-efficient technologies exert direct influence on gross profitability.

2.2. Developing evaluation criteria for Circular Economy participation in transportation infrastructure construction based on the APN framework

The APN Framework, proposed by the World Green Building Council, provides a foundation for assessing the level of circular economy (CE) participation in transportation infrastructure construction enterprises (TICEs) [16]. However, to make this framework practically meaningful, it must be operationalized into concrete criteria that are directly linked to enterprise activities and validated by prior research.

First, the leadership and policy dimension is demonstrated by enterprises adopting green standards in design and construction and integrating environmental reporting into corporate strategies or annual reports [17-19]. These practices highlight the leadership role in steering sustainable development and aligning with national CE policies.

Second, the technical solutions dimension includes the use of recycled or environmentally friendly [20, 21], the establishment of waste management plans and budgets [22], and the implementation of life-cycle assessment (LCA) for projects [23, 24]. These elements directly reflect the enterprise's technical innovation capacity within a CE context.

Third, the data dimension is represented by commitments to reducing CO_2 and greenhouse gas emissions [23, 25-27]. This requires enterprises not only to monitor emissions but also to disclose results transparently in periodic reports, thereby enhancing accountability.

Fourth, the financial dimension is expressed through investments in energy-saving technologies, reflecting the allocation of financial resources toward CE goals [28]. In addition, long-term financial planning for waste treatment, recycling, and technological innovation constitutes an essential part of this pillar.

Fifth, the mindset dimension extends beyond technical and financial measures, emphasizing the diffusion of circular thinking through internal training, employee awareness-building, and the engagement of partners and contractors. Although less quantifiable, this cultural foundation is vital for ensuring sustainable change [29].

Finally, as an outcome-oriented criterion that extends beyond the original framework, several studies highlight the achievement of green building certification as a direct and highly visible indicator of CE participation [30, 31].

Together, this set of criteria bridges the APN framework with both academic evidence and practical applications, ensuring that CE assessment in TICEs goes beyond conceptual discussions and captures the enterprises' actual capacity to implement circular practices effectively.

3. RESEARCH METHOD AND DATA

This study employs the fuzzy-set qualitative comparative analysis (fsQCA) method, which is appropriate given its ability to capture complex causal relationships and diverse configurations of conditions rather than focusing solely on individual effects. fsQCA is particularly effective in research contexts with small or medium-sized samples, where variables are likely to interact and be interdependent. Several related studies in business and management have adopted fsQCA to explore configurational models leading to performance outcomes. For example, Pappas and Woodside emphasized that this method enables the identification of optimal configurations in management and marketing [32]. In the construction field, fsQCA has also been applied to analyze the success of green building projects, demonstrating that technical strategies combined with financial management can produce different causal pathways that nevertheless converge on sustainable outcomes [33]. Therefore, applying fsQCA in this study to assess the joint impact of financial indicators and circular economy participation (CES) on the gross profit margin (GM) of transportation construction enterprises is both reasonable and supported by strong scientific foundations.

The study is guided by a theoretical framework integrating financial management theory and circular economy principles. Specifically, the framework posits that financial indicators such as debt-to-total-assets ratio (DTA), total asset turnover (TAT), fixed assets-to-total-assets ratio (FAT), and current ratio (CR) interact with circular economy participation (CES) to influence gross profit margin (GM). This approach builds on configurational theory, which emphasizes that outcomes emerge from combinations of interdependent conditions rather than isolated factors, and sustainable finance literature, which highlights the potential of circular economy practices to enhance long-term profitability when integrated with sound financial management.

The research data were collected from 20 listed transportation construction enterprises in Vietnam during the period 2020 - 2024, corresponding to 100 firm-year observations. The data sources include financial statements and annual reports. The sample was restricted to listed firms in order to ensure transparency and full accessibility of information, while also capturing the specific characteristics of the transportation construction sector an industry that requires strict financial management while simultaneously facing increasing pressure to meet sustainability demands.

The main outcome variable of the study is the gross profit margin (GM), defined as (Revenue - Cost of Goods Sold) divided by Revenue. GM serves as a direct measure of a firm's ability to generate profits from its core operations, while also reflecting the effectiveness of cost control and resource utilization in construction projects.

The condition variables are divided into two groups. The first group consists of core financial indicators, including the debt-to-total-assets ratio (DTA), total asset turnover (TAT), fixed assets-to-total-assets ratio (FAT), and the current ratio (CR). These variables were calibrated into fuzzy-set values based on sample percentiles; for variables expected to exert a negative influence, such as DTA, reverse coding was applied to reflect the risks associated with interest expenses.

The second group is the circular economy score (CES), which was evaluated through eight criteria reflecting the degree of participation in circular economy practices, aligned with the APN Framework. Each activity was assessed on a scale from 0 to 1, where 0 represents no participation, 1 indicates active participation, and 0.5 corresponds to partial engagement. Variable definitions and data sources are shown in the Table 1.

The circular economy score (CES) was constructed from eight criteria, and the coding process is described in detail as follows:

Adoption of green standards scored 0 if not mentioned, 0.5 if referenced without evidence of compliance, and 1 if formal adoption (e.g., ISO 14001) was reported; sustainability reporting in strategy or annual reports scored 0 if absent, 0.5 if general statements were provided, and 1 if a dedicated section with measurable targets was included; the use of recycled or environmentally friendly materials scored 0 if absent, 0.5 if occasionally mentioned, and 1 if systematic or quantitatively reported; waste treatment planning/budgeting scored 0 if no disclosure, 0.5 if acknowledged without budget details, and 1 if a formal plan with allocated budget was presented; life-cycle

Table 1. Variable Definitions and Data Sources

Variable Type	Variable	Definition		References	APN Framework Dimension
Condition Variables	DTA	Debt ÷ Total Assets		[11]	
	TAT	Revenue ÷ Total Assets		[13]	
	FAT	Fixed Assets ÷ Total Assets		[14]	
	CR	Current Assets ÷ Current Liabilities		[12]	
	CES = Composite Environmental Sustainability Index (8 criteria)	Evaluation criteria	Adoption of green standards	[19]	Leadership & Policy
			Environmental reporting in strategy or annual reports	[17, 18]	Leadership & Policy
			Use of recycled/environmentally friendly materials	[20, 21]	Technical Solutions
			Waste treatment planning/budgeting	[22]	Technical Solutions
			Life Cycle Assessment (LCA)	[23, 24]	Technical Solutions
			Investment in energy-saving technologies	[28]	Finance
			Commitment to CO_2/greenhouse gas emission reduction	[23, 25-27]	Data
			Green building certification	[30]	Output (additional to APN)
Outcome Variable	GM		Gross profit margin = (Revenue – Cost of Goods Sold) ÷ Revenue	[8]	

Source: Compiled by the author

assessment (LCA) scored 0 if absent, 0.5 if piloted, and 1 if fully conducted; investment in energy-saving technologies scored 0 if no evidence, 0.5 if only pilot initiatives were noted, and 1 if substantial or ongoing investments were reported; commitment to CO_2/greenhouse gas emission reduction scored 0 if absent, 0.5 if general commitments without targets, and 1 if quantified reduction goals were provided; and green building certification scored 0 if not pursued, 0.5 if in process or project-specific, and 1 if officially obtained (e.g., LEED, Lotus). For example, a firm mentioning waste management without budgeting would receive 0.5 for that criterion, while another disclosing a dedicated waste-treatment budget would receive 1.

The final CES for each firm-year was calculated as the average of all eight criteria, resulting in a continuous score between 0 and 1.

4. RESEARCH RESULTS

Descriptive statistics in Table 2 provide an overview of the characteristics of financial indicators and the extent of circular economy strategy (CES) adoption among the sampled firms.

The descriptive statistics indicate notable variation among financial indicators and CES participation in transportation construction enterprises. The debt-to-total-assets ratio (DTA) has a relatively high mean of 0.67859, reflecting widespread use of financial leverage in the sector. In contrast, asset turnover (TAT) averages 0.52053, suggesting that many firms have not fully exploited their existing asset capacity. Fixed assets as a proportion of total assets (FAT) are relatively low at 0.21262, indicating that many companies tend to lease rather than purchase fixed assets. The current ratio (CR) averages 1.22589, reflecting a reasonable balance between short-term assets and liabilities. Regarding circular economy adoption, the mean CES score of 1.845 on an eight-criteria scale demonstrates limited participation among firms. Gross margin (GM) averages 0.19246, ranging from -0.18679 to 0.67494, showing substantial differences in firms' ability to control costs and generate profits from core operations. The necessity test is a critical step in fsQCA analysis, assessing whether a single variable constitutes a nearly necessary condition for a given outcome, as shown in Table 3.

Table 2. Descriptive Statistics

Variable	Min	Mean	Max
DTA	0.22897	0.67859	0.90936
TAT	0.03706	0.52053	1.96681

FAT	0.00873	0.21262	0.84513
CR	0.30691	1.22589	3.31715
CES	0	1.845	5.5
GM	-0.18679	0.19246	0.67494

Source: fsQCA

The necessity test results indicate that no single variable can be considered an absolute requirement for achieving high GM, although some factors show substantial consistency. Notably, FAT has a consistency of 0.911 in predicting high GM, while its negation (~FAT) shows much lower consistency. This highlights the importance of maintaining a reasonable proportion of fixed assets to enhance profitability. Similarly, CR and TAT have consistencies above 0.70, indicating that liquidity and asset efficiency are important conditions supporting profitability. Conversely, for low GM, variables such as TAT (0.949) and CR (0.907) appear as necessary conditions, suggesting that in cases of weak management, these indicators can act as barriers rather than drivers of profit.

Regarding circular economy participation, CES shows a consistency of 0.725 in predicting high GM, lower than FAT but still indicating a significant supplementary effect. Conversely, CES also appears with a consistency of 0.793 for low GM, reflecting its dual role: if CES adoption is merely symbolic or not integrated with financial performance, it does not improve profitability. Compared to financial indicators, CES functions more as a complementary factor than an independent determinant. For instance, while DTA and CR exhibit clear contrasts between high and low GM, CES typically appears as a supportive condition within configurational combinations, suggesting that its effectiveness depends on alignment with sound financial management.

Configurational model analysis forms the core of the study, identifying multiple causal combinations that lead to the same outcome.

Table 4. Configurational Analysis Results (Truth Table)

Model: GMc = f(DTA, TAT, FAT, CR, CES)

Solution	DTA	TAT	FAT	CR	CES	Raw	Unique	Consistency
1		0		–		0.621	0.016	0.903
2	–		0		–	0.506	0.068	0.959
3			–	–	0	0.358	0.003	0.933
4	0	0	–			0.362	0.002	0.838
5	0		0	–		0.576	0.039	0.939
6		0	–		0	0.342	0.004	0.776
7	0		0		0	0.509	0.018	0.865
8		–	0	0	0	0.494	0.016	0.994

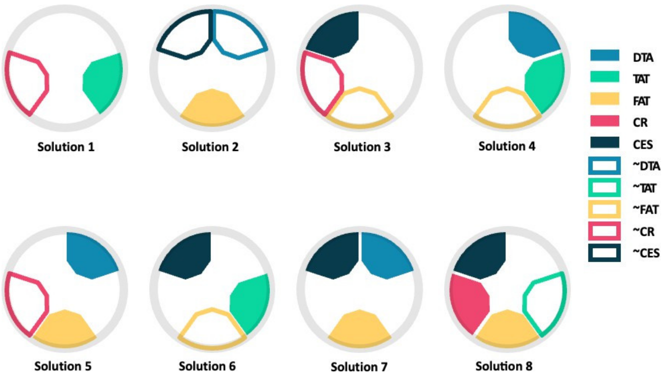

Figure 1. Causal Configuration Diagrams of Financial Indicators and CES Leading to High Gross Margin (fsQCA Results)

Table 3. Necessity Test Results

Outcome	Condition	Consistency	Coverage
Outcome: GM	CES	0.725	0.690
	~CES	0.632	0.783
	DTA	0.660	0.797
	~DTA	0.770	0.753
	TAT	0.714	0.625
	~TAT	0.665	0.939
	FAT	0.911	0.776
	~FAT	0.440	0.652
	CR	0.736	0.724
	~CR	0.754	0.905

Outcome	Condition	Consistency	Coverage
Outcome: ~GM	DTA	0.703	0.722
	~DTA	0.802	0.667
	TAT	0.949	0.707
	~TAT	0.496	0.596
	FAT	0.723	0.523
	~FAT	0.690	0.869
	CR	0.907	0.758
	~CR	0.670	0.684
	CES	0.793	0.647
	~CES	0.627	0.660

Source: fsQCA

The configurational analysis from Table 4 and Figure 1 reveal that multiple distinct pathways can lead to high gross margins (GM). The intermediate solutions indicate that no single financial indicator or CES acts as a necessary and sufficient condition on its own; rather, profitability emerges from the interplay among different conditions.

For example, Solution 1 demonstrates that the combination of high asset turnover (TAT) and low liquidity

(CR) can generate high GM, with a consistency score of 0.903. This pattern highlights an inverse relationship between liquidity and profitability: while higher liquidity usually signals financial safety, in transportation construction firms an excessively high CR may suggest idle capital that could otherwise be invested in profit-generating projects. In this sense, a lower CR when paired with efficient asset utilization reflects more effective use of financial resources, boosting profitability, though it also entails greater risks of short-term debt repayment.

The importance of fixed assets also emerges strongly in the results. FAT shows the highest consistency (0.911) among individual predictors of high GM, suggesting that a balanced share of fixed assets is nearly a necessary condition for profitability. This is logical in transportation construction, where large-scale projects depend heavily on machinery, equipment, and specialized vehicles. A sufficiently high FAT demonstrates internal operational capacity, reduces reliance on outsourcing, and ultimately enhances profit margins.

Beyond financial indicators, CES plays a complementary yet critical role. While CES alone does not guarantee higher GM, its presence in several solutions shows that it strengthens profitability when combined with favorable financial structures. For instance, Solution 2 shows that even with low TAT, high CES participation can still support strong profitability, acting as a compensatory mechanism. Most notably, Solution 8 illustrates that the simultaneous presence of high FAT, high CR, and high CES yields an almost perfect consistency (0.994). This indicates that when firms invest adequately in fixed assets, maintain sufficient liquidity, and actively engage in circular economy practices such as recycling materials, reducing waste, and adopting energy - efficient technologies, they create an optimal environment for profitability.

Taken together, these findings demonstrate that CES is not an absolute driver of profitability but becomes a powerful catalyst when strategically aligned with financial management. For transportation construction enterprises, this means that sustainability initiatives cannot remain symbolic or isolated; they must be integrated with asset management and liquidity strategies. Moreover, the asymmetry revealed by fsQCA highlights that even typically positive conditions, such as strong liquidity or high asset turnover, can contribute to low profitability if not managed holistically. Managers therefore need to pay attention not only to individual indicators but also to the overall configuration of financial and circular factors in order to optimize gross margins.

5. CONCLUSIONS AND IMPLICATIONS

The findings reveal that profitability in transportation construction enterprises is shaped by multiple pathways, where no single financial indicator or circular economy strategy (CES) guarantees success. Instead, high gross margin emerges from balanced financial configurations: efficient asset turnover, optimal fixed asset allocation, and controlled liquidity. CES alone does not secure profitability, but when integrated with sound financial management, it becomes a decisive catalyst that strengthens cost efficiency and long-term value creation. These results highlight the asymmetric nature of financial-sustainability interactions, suggesting that firms must treat CES not as a symbolic commitment but as part of a coherent financial strategy. For Vietnam's transportation construction sector, this alignment is particularly critical given the dual pressures of capital intensity and sustainable development goals.

Building on these insights, several strategic solutions can be proposed.

First, firms should optimize capital management by balancing liquidity and investment in the context of large-scale infrastructure projects. The results indicate that excessive liquidity can limit profitability if idle funds are not effectively deployed. In Vietnamese transportation construction, many firms maintain high cash reserves due to uncertainty in project payments or state funding schedules. To address this, managers should reinvest available funds into high-potential projects, such as urban highways, BRT corridors, or bridge construction, which are prioritized in national infrastructure plans. Accelerating accounts receivable turnover through stricter payment agreements with government agencies or subcontractors and optimizing the cash cycle by coordinating project schedules with financial flows can ensure that capital is actively generating returns while maintaining sufficient liquidity for short-term obligations.

Second, strategic long-term investment in fixed assets is critical. The high FAT identified in the analysis highlights that firms with sufficient machinery, specialized vehicles, and modern equipment can execute large-scale projects more efficiently and reduce reliance on rented equipment. In Vietnam, many construction enterprises rely heavily on leasing equipment due to high upfront costs. Therefore, investing in strategic fixed assets, including cranes, concrete mixers, and transport vehicles tailored for large infrastructure projects, not only enhances operational capacity but also improves gross margins by lowering outsourcing expenses. Adopting circular maintenance and repair practices such as scheduled overhauls, refurbishment of heavy machinery, and reuse of durable components can extend asset lifespan, reduce depreciation costs, and sustain long-term profitability.

Third, circular economy (CES) practices should be integrated with both financial and operational strategies. Although CES alone does not guarantee higher profits, it reinforces profitability when combined with strong financial management. In the Vietnamese context, this includes investing in technologies to recycle construction materials, such as concrete, steel, and asphalt, from old roads or bridges. Optimizing project design to reduce material waste and applying energy-efficient construction techniques such as prefabricated segments for bridges or low-energy asphalt mixing-can lower input costs while enhancing environmental compliance. These practices also improve access to capital from ESG-conscious investors, enhance corporate reputation, and align with Vietnam’s increasing sustainability requirements for public infrastructure projects.

Finally, operational and supply chain strategies should support these financial and circular initiatives. Firms can establish partnerships with suppliers providing recycled or sustainable materials, implement on-site material sorting and reuse programs, and minimize waste generation during construction. For specialized equipment, adopting “Product-as-a-Service” or rental-sharing models within project clusters can reduce capital expenditure while ensuring high asset utilization. Coordinating logistics for large infrastructure projects such as highways or urban transit corridors-can further reduce costs and improve gross margins by ensuring timely delivery of materials and optimal use of machinery.

By combining these strategies, transportation construction firms in Vietnam can achieve high profitability while maintaining operational efficiency and contributing to sustainable infrastructure development. The approach emphasizes holistic alignment between financial management, asset investment, and circular economy practices, directly addressing the specific challenges and opportunities of the sector.

In conclusion, this study shows that achieving high profitability in transportation construction requires a holistic approach, where financial management, asset investment, and circular economy practices are strategically aligned. The fsQCA results provide actionable evidence that managers must consider the configuration of multiple factors rather than individual metrics, offering a practical framework for integrating sustainability into financial decision-making while maximizing gross margins.

The limitation of this study lies in the relatively small sample size, which is constrained by the limited number of listed firms in the transportation construction sector. This may restrict the generalizability of the findings, and future research should consider expanding the sample or conducting cross-country comparisons.

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