A Conceptual Framework for Integrating ESG Profiling with Circular Economy Practices to Enhance Dual Dimensions of Firm Performance

Mahwish Rani
Department of Management, Universiti Teknologi PETRONAS, Seri Iskandar Perak, Malaysia
rani_21002185@utp.edu.my (corresponding author)

Fong Woon Lai
Department of Management, Universiti Teknologi PETRONAS, Seri Iskandar Perak, Malaysia
laifongwoon@utp.edu.my

Muhammad Kashif Shad
Department of Management, Universiti Teknologi PETRONAS, Seri Iskandar Perak, Malaysia
kashif.shad@utp.edu.my

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ABSTRACT

Firms are struggling to adopt Circular economy (CE) practices because of fragmented frameworks, inconsistent policy guidance, and the absence of standardized performance measures. This conceptual study addresses these critical gaps by developing a comprehensive CE framework that systematically categorizes the 9Rs (Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, Recover) into three strategic dimensions: material management, product management, and waste management. This tri-dimensional CE model provides firms with a practical framework to guide circular strategies throughout the product life cycle. The study examines how Environmental, Social, and Governance (ESG) profiling moderates the relationship between CE dimensions and firm performance, defined in terms of both financial and sustainable outcomes. This study proposes a quantitative approach using secondary data from sustainability reports of Malaysian manufacturing firms. A Circular Economy Index (CEI) is constructed to measure CE adoption, and ESG performance can be assessed using Bloomberg's ESG metrics. The proposed conceptual model serves as a foundational blueprint for future empirical validation and offers actionable insights for practitioners and policymakers seeking to align CE adoption with ESG imperatives in the transition toward a sustainability-oriented economy.

Keywords-circular economy; sustainable development goals; sustainable value; waste management

I. INTRODUCTION

CE has developed as a transformational framework that enhances resource efficiency, reduces waste, and promotes the continuous regeneration of materials throughout the product lifecycle. CE practices such as reduce, reuse, and recycling mitigate resource risks and support sustainable product design [1]. Despite these advantages, many firms view CE as a cost-intensive initiative rather than a driver of long-term value creation. This perception is reinforced by the limited empirical evidence of its financial benefits and the lack of clarity about how to measure CE practices effectively [2]. Despite the expanding literature on the CE, some gaps remain. First, existing studies employ fragmented and often overlapping CE indicators, which create uncertainty about which R-strategies, such as refuse and reduce, are most relevant in different contexts. Many firms struggle to select and prioritize appropriate R-strategies, raising concerns about how to operationalize CE in practice. There is a scarcity of organized frameworks that combine these practices into clear, actionable dimensions for firms to implement [3]. Second, previous research has primarily examined CE's impact in isolation, focusing on either environmental or financial outcomes while ignoring its broader contribution to long-term sustainable performance, particularly in relation to the United Nations Sustainable Development Goals (SDGs) [4]. Third, while Environmental, Social, and Governance (ESG) principles are gaining recognition in corporate strategy, their role as enablers or moderators in the relationship between CE and firm performance has received insufficient attention [5]. Contemporary research seldom examines how an ESG profile might help organizations secure resources, build stakeholder trust, and enhance the positive effects of CE adoption on

competitiveness and sustainability. To address these gaps in the literature, this study proposes a novel, operationally grounded framework that organizes the 9Rs of CE into three dimensions: material, product, and waste management, which correspond to the most important stages of manufacturing operations. Material management aims to optimize the sourcing of raw materials, enhance resource efficiency, and minimize input losses through refuse, rethink, and reduce practices. Product management encompasses design, production, and lifecycle extension, focusing on practices such as reuse, repair, refurbishment, repurposing, and remanufacture to extend product longevity and reduce environmental impact. Waste management focuses on end-of-life operations, extracting residual value and reducing landfill use through recycling and recovery practices. By aligning these R-strategies with the appropriate operational dimension, the framework provides firms with a clear roadmap for prioritizing CE practices and achieving measurable sustainability results.

Furthermore, this study proposes the dual impact of CE practices on financial and sustainability performance, examined through the lens of the SDGs. This approach illustrates how CE ideas can deliver immediate operational advantages while also fostering long-term value creation. The study links CE adoption to outcomes aligned with the SDGs, offering a comprehensive view of corporate performance and showing that CE practices are environmentally sustainable and strategically beneficial for competitiveness and resilience. Additionally, this study positions ESG profiling as a moderating factor that strengthens the relationship between CE adoption and firm performance, demonstrating how ESG can facilitate and accelerate CE implementation to create long-term value. Additionally, the framework makes a theoretical contribution by linking CE practices to ESG profiling and offers a model for future research on firm performance and sustainability outcomes. In practice, the framework helps managers identify operational priorities and make informed sustainability decisions, while also providing policymakers with insights to support and encourage the broader adoption of CE strategies.

II. LITERATURE REVIEW

A. Circular Economy

CE is an economic model that aims to eliminate waste, maximize resource efficiency, and keep products, materials, and resources in use for as long as possible. Over time, the CE framework has evolved into more comprehensive models. The most advanced and comprehensive iteration of the CE framework is the 9Rs, which provides a holistic approach to resource conservation and waste management. According to [6], the 9Rs: Refuse (R0), Rethink (R1), Reduce (R2), Reuse (R3), Repair (R4), Refurbish (R5), Remanufacture (R6), Repurpose (R7), Recycle (R8) and Recover (R9) collectively form the most robust interpretation of the CE model. Within this hierarchy, refuse is considered the most circular strategy, while recovery is the least preferred because it recovers only energy rather than material value. Furthermore, [7] refined the R-framework by adding Remine to recover valuable materials from waste streams and highlighted overlaps and inconsistencies in the application of the R-strategy, emphasizing the need for structured categorization to support effective CE implementation. Despite the growing literature, a critical gap remains in the systematic classification of the Rs. Most studies treat them either individually or in informal clusters. The present study groups the 9Rs into three strategic dimensions to help firms implement CE effectively.

1) Material Management in Circular Economy

Material management is crucial to the CE because it addresses resource efficiency and raw material reduction. Authors in [8] emphasized the importance of material productivity and resource optimization in circular strategies and sustainability goals, and authors in [9] stressed material efficiency as a critical demand-side intervention, notably for lowering carbon emissions through measures such as reuse, recycling, and resource substitution. Moreover, the authors in [10] stated that modular design, deconstruction planning, and on-site waste sorting were key to improving circular performance. These studies support the inclusion of material management as a distinct and strategically important component of CE frameworks. This dimension is fundamentally based on the principles of refuse, rethink, and reduction. While rethinking and reducing encourage innovation in product design to limit resource inputs, refusing encourages the rejection of non-essential, resource-intensive items. This dimension also supports early-stage evaluation of input materials to increase efficiency throughout the product's lifespan through circular strategies.

2) Product Management in Circular Economy

Product management is recognized as a critical dimension of the CE because of its direct role in extending product lifespans and preserving material value through strategies such as reuse, repair, refurbishment, remanufacture, and repurposing. Recent studies support this view by emphasizing the importance of product-level interventions in achieving circular outcomes. For instance, [11] highlighted that reuse and repurposing strategies are most effective when supported by modular product design and reverse logistics systems. Authors in [12] showed that integrating product lifecycle management with blockchain platforms enhances product traceability and strengthens circular practices such as remanufacturing. Further, authors in [13] underscored the role of advanced lifecycle analytics in enabling proactive repair and refurbishment strategies. Collectively, product management is a distinct and strategically relevant component within CE frameworks.

3) Waste Management in the Circular Economy

Waste management plays a crucial role in closing the material loop through recycling and recovery, and it is a core component of CE. This dimension reduces landfill waste and promotes the use of renewable materials by capturing the value of end-of-life resources. According to [14], sustainable waste management is essential for diverting waste streams and enabling resource recirculation. Complementing this, a study identified recycling and reuse as major drivers in solid waste management research, highlighting operational barriers and institutional insights necessary for CE adoption [15]. These recent studies reinforce the strategic need to treat waste management as a distinct, actionable CE dimension.

B. Corporate Performance

Firm performance reflects how a firm achieves its goals and creates value for its stakeholders. Traditionally, firm performance is evaluated using financial indicators. In recent years, it has been increasingly supplemented by sustainability-oriented measures, providing a more comprehensive understanding of organizational performance [16]. Therefore, this study focuses on two key dimensions of firm performance, financial and sustainability performance, as discussed in the following section.

1) Financial Performance

Corporate performance is frequently assessed using financial indicators that reflect a company's ability to generate profits and maintain market competitiveness. Financial performance is typically evaluated through both accounting-based and market-based metrics [17]. Accounting metrics such as Return on Equity, Return on Assets, and Return on Investment are intended to assess a company's operational efficiency and are sometimes viewed as short-term or retrospective indicators. These metrics offer insight into a firm's efficiency in using its resources to generate earnings [18]. The market-based measurement includes metrics such as earnings per share, Tobin's Q, cost of capital, and debt. Conversely, market-based metrics such as earnings per share, Tobin's Q, cost of capital, and debt ratios reflect investor expectations and judgments about a firm's prospective worth. In a progressively competitive landscape, companies are compelled to prioritize profitability and sustainability as essential measures of financial well-being.

2) Sustainability Performance

Sustainability performance denotes a company's capacity to generate long-term value by meeting ESG objectives, closely aligned with frameworks such as the SDGs [19]. According to [20], modern firms are assessed not only on their financial performance but also on their impact on social welfare and environmental responsibility. By integrating sustainability into their core strategy, firms demonstrate responsible business practices, enhance legitimacy, and strengthen stakeholder trust. This transition signals a more comprehensive perspective of company performance, in which financial viability and sustainable impact mutually reinforce one another. Despite the growing incorporation of sustainability into company strategies, a significant gap persists in systematically assessing sustainable performance alongside financial performance. This study addresses this gap by offering a systematic approach to evaluating both aspects, guiding firms to enhance resilience, innovation, and long-term stakeholder value.

C. ESG Implementation Profiling

The corporation's dedication to ESG reduces business risk and lowers the company's cost of capital. A company's social success is measured by its community ties, product transparency, respect for individual rights, and workforce excellence. In addition, reducing resource use and greenhouse gas emissions reflects the firm's environmental commitment. Furthermore, a company's corporate governance activities reveal the rights and obligations of its management. ESG considerations can be advantageous in several ways, including lower taxes, reduced operational risk, stronger contract negotiation skills, improved customer retention, and greater brand recognition. Authors in [21] have highlighted how an enterprise's environmentally friendly procedures improve its cash flow. Previous studies show that ESG profiling encourages investment in sustainable practices, such as CE, as stakeholders increasingly prioritize environmental, social, and transparent business practices.

III. THEORETICAL FRAMEWORK

A. Institutional Theory

According to institutional theory, organizations are influenced by external forces that require them to follow established institutional norms and procedures. Governments, regulatory authorities, and international organizations increasingly promote CE principles and rules. This creates institutional pressure on organizations to adopt CE practices to meet sustainability norms and expectations. By adhering to institutional standards, organizations seek legitimacy and societal approval. Embracing CE principles can help an organization gain credibility with stakeholders, including investors, customers, and regulators. This legitimacy-seeking process depends heavily on sustainable performance. Organizations can demonstrate their commitment to sustainability and their positive ecological and societal impact by implementing CE [22].

B. Stakeholder Theory

Stakeholder theory emphasizes the balance of stakeholder interests as the most critical factor in business policy. A stakeholder approach by [23] defines stakeholders as any individual or group that may be affected by the firm's success in achieving its goals. Multiple stakeholder groups, including owners, employees, creditors, suppliers, consumers, government, and the local community, may be interested in a business's activities and conduct. They have the right to know how those activities will affect them, even if they cannot directly contribute to the organization's existence. This approach shifts the focus of firm plans from solely considering shareholders to external stakeholders [24]. Stakeholder theory's applicability is established through ESG implementation profiling. It discusses all facets of sustainability and how they affect firm performance. The firm's value depends on the quality of its interactions with its many stakeholders, and the happiness of these stakeholders enhances the firm's goodwill, ultimately increasing its value. Therefore, within the context of stakeholder theory, it is established that CE practices and ESG implementation profiles boost the firm's worth.

IV. HYPOTHESIS DEVELOPMENT

A. Circular Economy Impact on Firm Performance

CE practices can improve a company's corporate strategy by reducing energy use, raw material consumption, and production costs. Many scholars have found the positive impact of CE on firm performance, as measured by Return on Assets (ROA). A study examined the implementation of CE initiatives and their impact on profitability [25]. In addition, [26] analyzed the CE and its financial perspective, and used Tobin's Q as a proxy for firm performance. Although the literature supports

the idea that adopting CE has a positive effect on firm performance, there is no evidence of a relationship between CE practices and a firm performance proxy from a sustainability and profitability perspective. Therefore, this study investigates the effect of CE on firm performance, using the weighted average cost of capital and return on assets as proxies for firm performance, and SDGs as a proxy for the firm's sustainability performance. Based on the above discussion, this study proposes the following hypothesis, H1: Circular economy practices positively impact a firm's financial and sustainability performance.

1) Material Management (as a CE Dimension) Impact on Firm Performance

CE practices enable sustainable material handling by promoting resource efficiency, waste minimization, and the continuous circulation of materials within production systems. Firms can focus on CE strategies such as refuse, rethink, and reduce to improve material efficiency, mitigate environmental damage, and develop more sustainable and resilient business models. Rethink compels companies to re-engineer products, processes, and business models [27]. Refuse reduces expenses and pollution by eliminating unsustainable materials and practices [28]. By applying these principles, companies enhance profitability, reinforce environmental commitments, and increase resilience during the CE transformation. Therefore, this study intends to test the following hypothesis, H2: Material management has a significant positive effect on financial and sustainability performance.

2) Product Management (as a CE Dimension) Impact on Firm Performance

Effective product management in the context of circularity generates value for organizations. Reuse is viable for products because it preserves most of their resource value. This entails directly reusing a product in its original condition for its intended function as secondhand. If a product ceases to perform appropriately, repair practice seeks to restore it to operational condition. By replacing components, refurbishment improves the product's quality and updates it to modern standards [29]. Lastly, repurposing uses discarded products or components for a new purpose. Through CE practices, products extend their lifespan, reducing replacement frequency, lowering material dependency, and improving financial stability. It also fosters customer loyalty and repeat business, creating additional revenue streams and strengthening financial stability. Therefore, the following hypothesis, H3, is proposed: Product management has a significant positive effect on financial and sustainability performance.

3) Waste Management (as a CE Dimension) Impact on Firm Performance

Waste management is a key component of the CE, helping reduce waste and recover resources to increase efficiency. Key measures include recycling and recovery. Recycling reintroduces materials into production cycles after they've been used, keeping resources in circulation and lowering reliance on new materials. In fact, [30] found that using recycled parts can reduce supplier dependence by lowering the required volume per supplier. Recovery refers to extracting value from waste or by-products that cannot be reused or recycled. This method has the lowest priority among the CE approaches; however, it remains preferable to landfill waste processing [31]. Through these practices, firms can achieve economic benefits and environmental sustainability while reducing their reliance on resources. Therefore, this study proposes the following hypothesis, H4: Waste management has a significant positive effect on financial and sustainability performance.

B. The Moderating Effect of ESG in the Relationship between Material Management and Firm Performance

Material management, as a dimension of CE, underscores the effective use of resources by rethinking and reducing raw material consumption. These initiatives contribute to environmental sustainability while simultaneously reducing operational costs [32]. However, an organization's ability to convert material efficiency into enhanced financial and sustainability performance often depends on governance mechanisms, stakeholder pressures, and institutional quality. ESG serves as a comprehensive framework that promotes transparency, ensures compliance, stimulates efficient resource use, and strengthens material management's credibility by linking it to broader sustainability goals [33]. ESG profiling is also viewed as a driver of ethical investment that positively impacts an organization's bottom line. Therefore, based on the above discussion, this study proposes the following hypothesis, H5: ESG profiling moderates the relationship between material management and financial and sustainability performance.

1) The Moderating Effect of ESG in the Relationship between Product Management and Firm Performance

Product Management in the CE involves reuse, repair, remanufacturing, refurbishment, and repurposing to extend the product life cycle. These approaches reduce material and cost while fostering innovation and consumer loyalty, thereby improving financial performance [34]. These practices reduce environmental impact and advance sustainability performance. Their full potential is realized through ESG frameworks, particularly environmental stewardship, which helps mitigate risks and build trust with customers and investors. Therefore, the following moderate H6 hypothesis is proposed: ESG profiling moderates the relationship between product management and financial and sustainability performance.

2) The Moderating Effect of ESG in the Relationship between Waste Management and Firm Performance

The CE focuses on waste management, including recycling and recovery, to reduce environmental impact and recover value from end-of-life products. These strategies influence firm performance from both financial and sustainability perspectives [35]. The effectiveness of these techniques often depends on overarching institutional and governance frameworks that enable their integration into core corporate activities. Companies with robust ESG integration are more likely to invest in advanced waste-processing technology, comply with environmental regulations, and cultivate a culture of environmental accountability. ESG strengthens stakeholder trust and investor appeal, thereby amplifying the benefits of CE-driven waste management measures. Therefore, the following moderate hypothesis is proposed, H7: ESG profiling

moderates the relationship between waste management and financial and sustainability performance.

C. Control Variables

Control variables account for firm-specific factors that may affect performance. This study controls firm size and age. Firm size, measured by total assets, reflects resource availability and exposure to regulatory and public pressure, which may drive stronger ESG profiles and greater adoption of CE practices. Firm age captures organizational maturity and reputation, and older firms often exhibit stronger ESG engagement and CE implementation.

V. CONCEPTUAL FRAMEWORK

This study proposes a conceptual framework (Figure 1) that integrates CE practices and ESG profiling to explain their joint influence on firm performance.

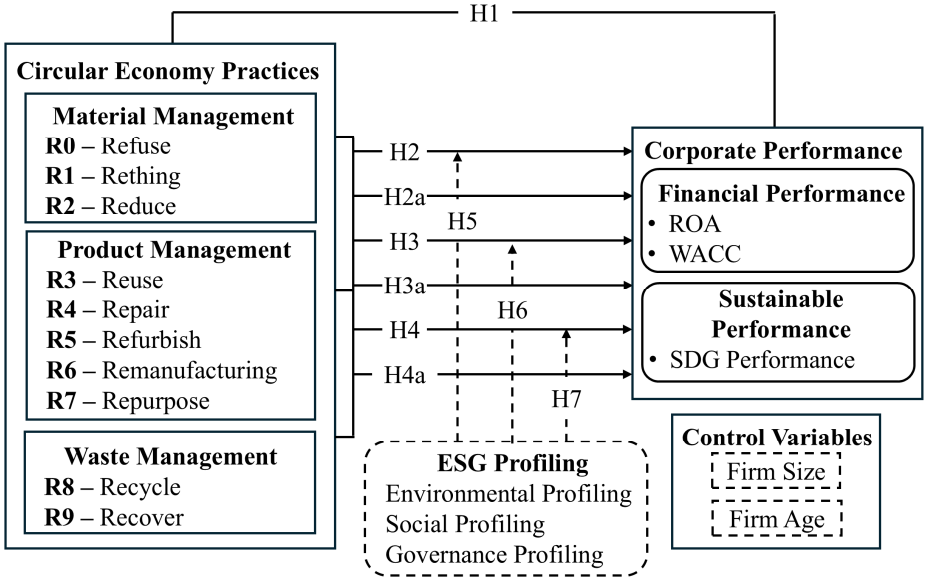

Fig. 1. Conceptual framework of this study.

VI. METHODOLOGY

A. Population, Sampling, and Data Collection

This study focuses on large Malaysian manufacturing firms. Large manufacturing enterprises are defined as those employing more than 200 full-time personnel or generating annual sales turnover above RM50 million (SME Corporation Malaysia, 2020). Malaysia's Federation of Manufacturers identifies 661 large manufacturers. Based on the [36] sampling table, a sample of 246 firms may be considered for future empirical validation. This study uses secondary data from 2016 to 2022 and advocates a weighted content analysis approach. Weighted disclosure indices are considered more robust than unweighted ones. Consequently, evaluation of CE practices can be structured based on the weight of content analysis techniques (0 to 3). 0 indicates no reporting. 1 is a descriptive outline. 2 indicates quantified data, and 3 indicates quantitative data over time. Ordinary Least Squares (OLS) regression is recommended and can be conducted using software such as Stata.

B. Operationalization of the Variables

The CE practices can be evaluated through sustainability reports by using (1).

$$CE\ Practices = \frac{No.\ of\ discloused\ items\ per\ section}{Total\ No.\ of\ items\ per\ section} \quad (1)$$

The firm's performance is proxied by financial and sustainability metrics. Financial performance can be measured using the weighted cost of capital and return on assets. SDG goals can serve as a proxy for sustainability performance and can be measured using dummy variables 0 and 1, where 0 indicates the absence of goals and 1 indicates the disclosure of any of the 17 goals. The average score of goals a company contributes toward the total of 17 development goals can be measured using (2).

$$SDGs\ Av.Score = \frac{No.\ of\ goals\ disclosed\ by\ a\ compny}{Total\ of\ 17\ SD\ goals} \quad (2)$$

ESG implementation profiling can be measured using Bloomberg's ESG metrics and a content analysis scale, where 0 = no reporting, 1 = partial reporting, and 2 = complete reporting. ESG implementation profiling will be calculated using (3):

$$ESG\ Impl.Profiling = \frac{No.\ of\ disclosed\ items\ per\ section}{Total\ No.\ of\ items\ per\ section} \quad (3)$$

Firm size is measured using the natural logarithm of total assets ($Ln_{(total\ assets)}$). This study uses the natural log to measure the company's age by using (4).

$$Ln_{(total\ assets)} = Current\ year - Incorporation\ year \quad (4)$$

VII. CONCLUSION

This study presents a structured framework that integrates CE practices with ESG profiling to improve firm financial and sustainability performance. By categorizing the 9Rs into operationally relevant dimensions, the framework provides managers with actionable guidance to prioritize strategies at each stage of production to create long-term value. It also offers policymakers actionable suggestions for supportive policies that incentivize sustainability initiatives. Furthermore, this study provides a roadmap for firms to achieve competitiveness, resilience, and sustainable growth.

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