

IMPACT OF CIRCULAR ECONOMY PRACTICES ON ENVIRONMENTAL PERFORMANCE IN SMES MANUFACTURING FIRMS: MEDIATING ROLE OF ORGANIZATIONAL GREEN CULTURE

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Abstract

This represents an original contribution to the Resource-based view (RBV) theory because it investigates the relationship between Circular Economy Practices (CEP), Organizational green Culture (OGC), and the environmental performance of small and medium-sized enterprises (SMEs) in the manufacturing sector of Pakistan. It is quantitative research and uses a normal structured survey process of collecting primary data from various SME employees, thus giving us a total sample size of 208. Statistical techniques such as structural equation modeling are used to analyze for positive relationships of the solid and direct constructs and find Circular Economy Practices that significantly influence Organizational Green Culture and Environmental performance. In addition, the results from the study have practical implications for SMEs. Findings from the partial mediation of circularity practices on the relationship between organizational green culture and environmental performance point to the importance of organizational green culture in increasing sustainability outcomes. In addition, the study extends the RBV theory to show how circular economy practices can act as strategic resources to reinforce organizational culture and environmental performance. In light of the above, the paper emphasizes the need to achieve the benefits of circular practices by integrating sustainability into SME core strategies and creating a green organizational culture. With a clearer understanding of the actual costs, SMEs now have a guide to follow for greener operations and to become environmental leaders in environmentally responsible practice.



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Keywords: *Circular Economy Practices; Environmental Performance; Organizational Green Culture*

Introduction

The environmental performance of small and medium-sized enterprises (SMEs) in manufacturing sectors of developing countries has several significant challenges (Rajapakse et al., 2022). These firms, however, tend to be resource-limited, so they do not invest in sustainable technologies or practices. Additionally, SMEs may have no or poor incentive to adopt environmentally friendly practices due to a lack of regulation in such cases (Javed et al., 2022). Many SMEs' environment's short-term economic gains are often made at the long-term economic expenses of sustainability. Likewise, robust strategies must be improved by increasing awareness and knowledge of such benefits of environmental management systems. Additionally, because this does not follow strict environmental standards, the economy of large companies is not concerned about the environment. Policymakers must offer incentives, training programs, and clear regulations to induce small and medium enterprises (SMEs) to cultivate more sustainable behavior for environmental performance (Baskaran et al., 2023).

This economic model, called the circular economy, deals with the resources that are hardly used in the linear take, make, and dispose of a model (Awan & Sroufe, 2022). The first method highlights keeping material circulated in the system for a relatively longer time, minimizing the wastage across processes and the resultant effect on the environment, and helping exert its influence on sustainable production and consumption conditions. There is a need to relate circular economy practices to environmental performance that can reduce the depletion of resources, decrease greenhouse gas emissions, and increase biodiversity by reducing pollution. Furthermore, other research has demonstrated that organizations employing circular economy principles have improved environmental performance and have competitive advantages, such as lower costs and greater brand loyalty (Rodríguez-Espíndola et al., 2022). In particular, these studies show that the companies practicing

these practices have higher resource use efficiency, lower operational costs, and greater resilience to resource scarcity. In this grey, dark, and ever-shrinking world, we care more and more about climate, sustainability, transport, energy, nutrition, health, and almost everything else; in a world where we want to take up environmental and social challenges, where we want to drive the future; the practice of circular economy has emerged as something that we can do, an option, an approach to address those needs.

According to Fok et al. (2023), an organizational green culture is a collective set of values, awareness, or beliefs supported by practices simultaneously within a company aiming to be environmentally sustainable with favorable eco-friendly practices. This culture is very much about environmental stewardship, including waste reduction, energy efficiency, and sustainable sourcing, which are the cornerstones of better overall environmental performance. Sustainability is about how organizations think, and by doing so, they can embrace more aggressive circular economy strategies such as recycling, resource efficiency, and product life extension and generate better environmental outcomes. In addition, it was discovered that organizations with green solid cultures are more successful in developing and holding circular practices, resulting in significant waste and emissions reduction (Kwarteng et al., 2022). This helps to underscore the criticality of enabling the strength of a green culture as an enabler towards further amplifying the value of the circular economy initiatives and, consequentially, integration and a more sustainable operational posture.

In light of circular economy practices, the current work demonstrates how they impact the environmental performance of small and medium-sized enterprises and manufacturing firms in Pakistan, which remains an underexplored area in academia. While there has been an emergent stream of literature on circular economy initiatives, more attention should be paid to it in the context of SMEs in developing

countries like Pakistan (Cantú et al., 2021), (Kusi-Sarpong et al., 2023), (Shahzad & Arslan, 2024). Specifically, the gap is essential as SMEs occupy a crucial position in the national economy and are significant contributors to environmental deterioration due to limited resources and poor environmental management practices. Previous studies, too, have proposed organization green culture as a possible mediator between circular economy practices and environmental performance; nevertheless, empirical proof of such a relationship is not available in the context of Pakistani SMEs (Aggarwal & Agarwala, 2023). Additionally, there is a requirement to explore the peculiarities of the circular economy implementation challenges faced by Pakistani SMEs, including regulatory barriers, access to technology, and culture to favor these forms of sustainability. This paper addresses these gaps by developing tailored strategies to improve SMEs' environmental performance and advance broader sustainability issues in Pakistan's manufacturing sector.

Literature review and theoretical framework

Theoretical foundation

According to RBV, a firm's resources and capabilities are the critical determinants for its competitive advantage and overall performance (Beigi et al., 2023). Within this context, circular economy practices are helpful resources for small and medium enterprises (SMEs) that they can utilize to support their sustainability activities. These practices allow the firm to reduce resource consumption, minimize waste, and encourage innovation, resulting in environmental performance. In this framework, the organizational green culture mediates, integrating into the attitudes and behaviors of employees and promoting a circular economy orientation of sustainable practices. Circular practices are effectively implemented in a robust green culture that amplifies those positive impacts on environmental performance (Al Doghan et al., 2022). However, when these variables are integrated within the RBV framework, it becomes clear that organizational

resources, including a supportive culture and innovative circular practices, can significantly improve environmental outcomes for an SME, emphasizing that sustainable practices are not only compliance measures but resources with strategic value and key to the ongoing success of the business.

Hypothesis development

Circular economy practices

The research results suggest that firms employing circular economy practices (i.e., recycling, resource efficiency, and product life extension) waste less and achieve better sustainability, thereby increasing environmental performance (Dey et al., 2022). At the same time, a green organizational culture is robust enough so that all its employees are engaged and willing to take the lead in initiating or promoting such sustainable practices. Initial studies indicated that organizations with a robust green culture are more likely to adopt innovative circular strategies, resulting in improved environmental performance (Marrucci et al., 2021). The arguments supporting these three variables imply that circular economy practices are essential for SMEs in developing their sustainability and that organizational green culture is an important facilitator of the relationship between these practices and environmental performance. Together, they reinforce that sustainable practices can only be implemented if they are seamlessly integrated into the organizational outlook as the way to long-term environmental goals. These variables also show the nature of the relationship between these variables, and it is also essential to consider leadership and communication as the means to establish a green culture. Sustainability is taken up as a philosophy by leaders who set an example by doing what they can to promote a sustainable and environmentally friendly culture (Liu & Lin, 2020). In addition, strategies for communication that effectively convey the importance of the continuous improvement of circular economy initiatives and their impact on environmental performance will further reinforce this culture so

that all employees begin to understand that they are a part of achieving sustainability goals.

H1: CEP has positive and significant impact on EP.

H2: CEP has positive and significant impact on OGC.

Mediating role Organizational Green Culture

Considering the context of sustainability and competitive advantage, the interaction between circular economy practices, organizational green culture, and environmental performance is significant to SMEs. Based on the Resource View (RBV), where one focuses on the strategic utilization of resources, practicing the circular economy is not just about legislation but a strategic move that creates long-term benefits (Coppola et al., 2023). Similar to recycling and resource efficiency, reducing operational costs as well as improving a firm's reputation, attracting environmentally conscious consumers and investors. In addition, organizational green culture must be addressed in every way. Forcing an organization to be green is not the same as cultivating a robust green culture, which then creates an intrinsic motivation in employees to engage in sustainable practices and commitment to that sustainability to a greater extent than just complying (Abbas & Dogan, 2022). Such a culture encourages knowledge sharing, innovation, and collaboration among firms, enabling synergies associated with collective expertise in developing and implementing circular strategies (Ersoy et al., 2022).

Research has established that empowered employees who feel connected to the company's environmental goals are more likely to come up with creative ideas for saving the planet and consistently participate in sustainability efforts (Liu et al., 2020). Moreover, it can make the organization more resilient to external forces such as regulatory changes and turbulent markets by flying the saying of the circular economy through embedding sustainability into the organizational framework. SMEs can leverage a faster-changing ecosystem to bring their plan to

market through the integrated BLSS model. A synergy between circular economy practices, environmental performance, and organizational green culture has been found to support SMEs' adoption of a holistic approach to sustainability (Subramanian & Suresh, 2022). This will help SMEs understand eco-friendly performance better and also help them lead the way towards sustainability in the long run by becoming leaders in the sustainability of an eco-friendly market.

H3: OGC has positive and significant impact on EP.

H4: OGC is mediates the relationship between CEP and EP.

Methodology

Data collection procedure

This research used the quantitative research design to collect primary data through the survey method to test the impact of circular economy practices and organizational green culture on environmental performance in SMEs in Pakistan. We deal with employees working in small and medium-sized manufacturing enterprises as the target population. A total of 208 samples were considered for this study. A structured questionnaire was developed to gather data on three key variables: organizational green culture, circular economy practices, and environmental performance. To this end, a questionnaire used a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Based on the SME landscape in Pakistan, stratified random sampling was done to provide a diverse representation from different sectors within the SME landscape. The survey was conducted electronically and directly within participating SMEs with reminder follow-ups to encourage participation and assure respondents of confidentiality. This source enables the inclusion of employees at different levels of the organization, including managerial, operational, and support staff, because it gives a comprehensive view of the organizational culture and practices. Data collection was finished, and

statistical software SEM analysis was utilized to test the proposed hypothesis.

Measurement

CEP: In short, the circular economy is a set of strategies and actions that seeks to minimize waste and facilitate the transformation of resources at their highest value to route energy and material throughput flows. The goal is that such practices should focus on sustainability. It aims to recycle, reuse material, refurbish products, and design for longevity (Lim et al., 2022). This was formed from the study by (Amin et al., 2024), with the remaining six items.

OGC: Green culture in an organization is about a set of shared values, beliefs, and practices that promote an environmentally sustainable environment and encourage green behavior by employees (Hooi et al., 2022). It is a culture of environmental stewardship. Thus, it takes proactivity in sustainability ourselves, and it is one that leadership supports. The six items of the research (Wang, 2019) were again adopted.

EP: Environmental performance relates to the results of an organization's environmental management (Kraus et al., 2020). Indicators that measure the organization's impact on reducing waste generation, energy use, greenhouse gas emissions, and resource use. The research of (Le et al., 2024) was used to consider the five research items we looked at.

Results and Discussion

Reliability and Validity

Table 1 provides a comprehensive overview of the factor analysis results for three key constructs: The Circular Economy Practices, Organizational Green Culture, and Environmental Performance. The item loadings (CEP1-CEP1) indicate good correlations (i.e., values greater than or equal to 0.70) with the

underlying Construct range from 0.798 to 0.822 for Circular Economy Practices. Moreover, the internal consistency amongst the items of this Construct is relatively high as the Cronbach alpha value for this Construct is 0.896, which is more than the standard threshold of 0.70 (Kennedy, 2022). Furthermore, the composite reliability (0.920) further supports the scale's reliability. The average variance extracted (AVE) for Circular Economy Practices (0.658) is well above the suggested threshold of 0.50, thus confirming that the Construct can explain much of the variance in these items and implying that the Construct is valid. Likewise, the Organizational Green Culture items show strong item loadings ranging between 0.766 at the highest and 0.893 at the lowest, all above the 0.70 threshold, supporting the operationalization of this variable. The Cronbach alpha value of 0.914 is very high, with extremely high internal consistency, and the composite reliability of 0.934, which is very impressive; the measurement scale is highly reliable. AVE for Organizational Green Culture = 0.701, indicating that the items are good at capturing the variance in the Construct. The item loadings (EP1 to EP5) also show strong relationships with the Construct. For example, EP1 shows a loading of 0.903. The Cronbach alpha for this Construct is 0.898, showing high internal consistency, and the composite reliability is also 0.924, which indicates high reliability. The AVE for Environmental Performance is 0.710, above the acceptable threshold, and suggests that the items offer a valid measure of the Construct.

Overall, Table 1 demonstrates a reliable and valid assessment of the Circular Economy Practices, Organizational Green Culture, and Environmental Performance measurement scales with sufficient robustness to be used in future analysis of how the relationships between Circular Economy Practices, Organizational Green Culture, and Environmental Performance.

Table 1 Reliability and Validity

FACTOR	ITEMS SPSS CODING	ITEM LOADING	CRONBACH ALPHA VALUE	COMPOSITE RELIABILITY	AVERAGE VARIANCE EXTRACTION
CIRCULAR ECONOMY PRACTICES	CEP1	0.805	0.896	0.920	0.658
	CEP2	0.807			
	CEP3	0.815			
	CEP4	0.822			
	CEP5	0.819			
	CEP6	0.798			
ORGANIZATIONAL GREEN CULTURE	OGC1	0.830	0.914	0.934	0.701
	OGC2	0.818			
	OGC3	0.849			
	OGC4	0.893			
	OGC5	0.863			
	OGC6	0.766			
ENVIRONMENTAL PERFORMANCE	EP1	0.903	0.898	0.924	0.710
	EP2	0.813			
	EP3	0.813			
	EP4	0.867			
	EP5	0.815			

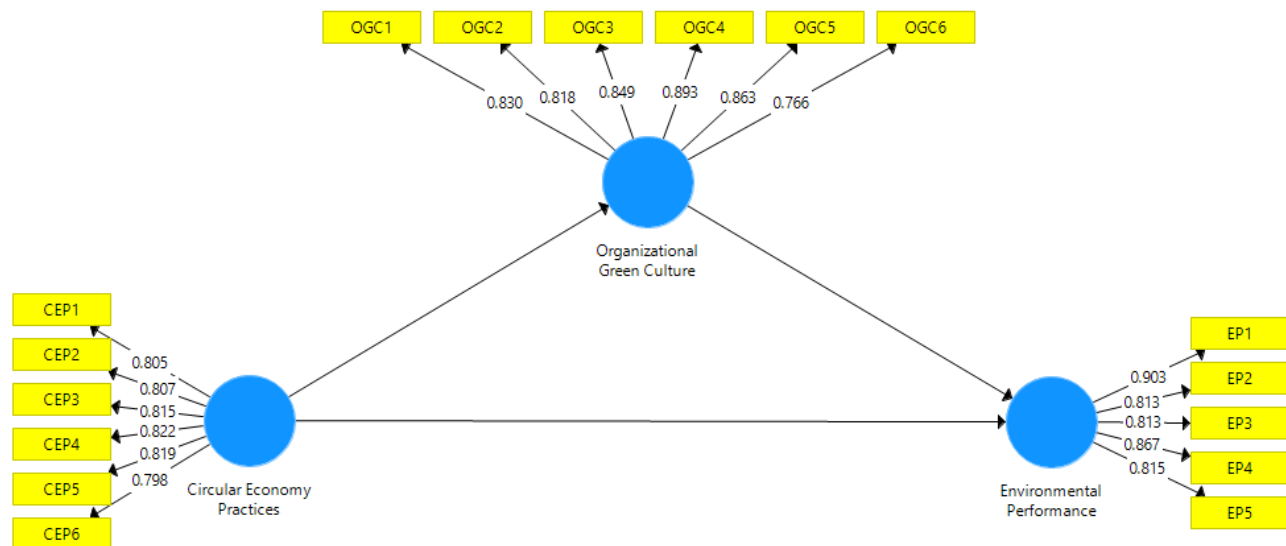


Figure 1 Measurement Model

Direct and indirect Effects

A decision about the hypotheses is made, which involves determining the direct and indirect effects between the constructs of Circular Economy Practices, Organizational Green Culture, and Environmental Performance. Table 2 presents each hypothesis's respective beta values, standard deviations, and t-values.

A beta value of 0.415 with an SD of 0.061 on beta leads to a t-value of 6.815 on the first path from Circular Economy Practices to Environmental Performance. Since our t value is this strong, we can say there is a significant

positive effect, so we accept the hypothesis. This implies that the environmental performance has improved substantially for SMEs who adopt circular economy practices. The second path, from Circular Economy Practices to Organizational Green Culture, has a beta of 0.724, a std dev of 0.031, and a t value of 23.709. The adoption of circular economy practices is found to have a robust and significant relationship with an organization's green culture; this exceptionally high t value confirms that the organizational green culture is greatly improved when circular economy practices are adapted at

SMEs. Based on the third path, from Organizational Green Culture to Environmental Performance, the beta value is 0.413, the standard deviation is 0.063, and it has a t value 6.601. This also suggests a solid organizational green culture overall effect, implying that good environmental performance is closely intertwined with it and is not directly correlated. Finally, it is shown that the indirect effect of Circular Economy Practices on Environmental Performance through Organizational Green Culture is statistically significant, with a beta value of 0.299, a standard deviation of 0.048, and a t-value of 6.185. This result indicates a partial mediation effect, such that while

circular economy practices directly affect environmental performance, a proportion of this effect is mediated by organizational green culture.

In summary, the result points out that Circular Economy Practices significantly boost Organizational Green Culture and Environmental Performance, the latter of which is a central mediating variable. This supports the argument that creating a green culture in organizations to amplify circulation economy practices' environmental outcomes is essential.

Table 2 Direct and Indirect Effects

Path direction	Beta value	Standard Deviation	T-value	Decision
Circular Economy Practices -> Environmental Performance	0.415	0.061	6.815	Accepted
Circular Economy Practices -> Organizational Green Culture	0.724	0.031	23.709	Accepted
Organizational Green Culture -> Environmental Performance	0.413	0.063	6.601	Accepted
Circular Economy Practices -> Organizational Green Culture -> Environmental Performance	0.299	0.048	6.185	Partial Mediation Effect

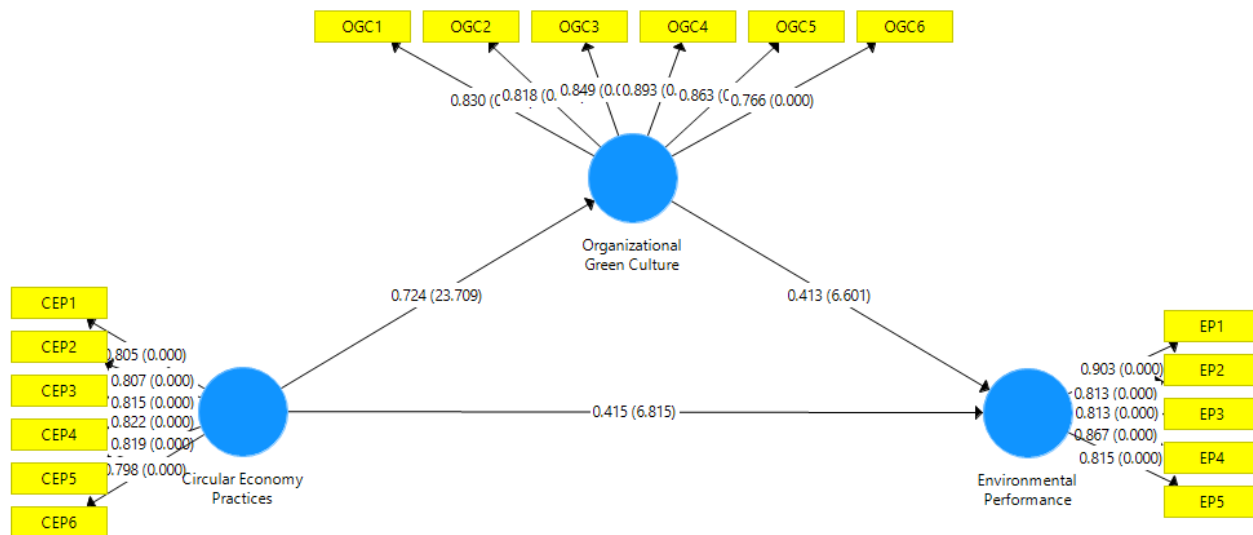


Figure 2. Structural Model

Discussion on Results

H1: The results also confirmed a significant positive relation between Circular Economy Practices and Environmental Performance in SMEs in the manufacturing sector, with a Beta value of 0.415 and t value of 6.815. Overall, this is supported by what earlier literature has stated about adopting circular economy-based principles to achieve sustainability outcomes. Previous studies showed that introducing a framework like recycling, resource efficiency, and waste reduction reduces environmental impacts, operational efficiency, and cost savings (Incekara, 2022). One example of this is how research has found that SMEs taking on a circular economy approach can minimize material costs and reduce fees for waste disposal, improving their overall environmental performance. The finding was necessary to highlight that circular economy practices are, in fact, a critical contributor to sustainable development goals, especially in developing countries, where SMEs play a significant role in economic development (Ogunmakinde et al., 2022). Additionally, these practices have shown a positive effect on environmental performance and underscore the need for the integration of sustainability in the SME core business strategies. Globally, the focus on environmental responsibility grows, and the

results of this study attest to compelling evidence for SMEs to adopt circular economy practices as imperative of regulation but as a means of gaining competitive advantage (Rehman et al., 2023).

H2: Results showed that Circular Economy Practices are robust and positively related to Organizational Green Culture (beta = 0.724, t = 23.709). This shows that circular economy practices are implemented to cultivate a sustainable culture in SMEs within the manufacturing industry. The results align with earlier research on this topic, where organizations that adhere to circular economy (CE) principles create a sociotechnical context where employees are engaged (Diaz et al., 2022). SMEs achieve better performance when they practice, e.g., recycling, resource optimization, and product life extension. As the study showed, the impact of circular economy practices on organizational green culture, leadership, and strategic communication is crucial in creating an organization that encourages sustainability (Obeidat et al., 2023). Leaders who set a tone for organizational culture promote and live sustainable behaviors so employees can adopt these values.

H3: A beta value of 0.413 and 0.601 t-value confirms an excellent positive relationship

between Organizational Green Culture and Environmental Performance. This finding implies that GM culture strength in manufacturing SMEs matters in improving their environmental performance. This is consistent with previous studies that support the finding that an organization's culture is steering sustainability initiatives (Wijethilake et al., 2023). Research over and over again has revealed that organizations that create a culture that values environmental stewardship have employees who are more willing to practice sustainability and where there is bottom-line environmental impact. The green culture within the organization is very robust in motivating employees to participate in sustainability, reduce waste, consume more energy, and promote eco-friendly behaviors (Rosyanti et al., 2023). Despite this collective commitment, the culture of accountability fosters empowerment, and it imbues employees to suggest and enact innovative ideas congruent with sustainability goals (Ahmad et al., 2024). Results confirm the need for creating a viable green culture to guarantee long-term environmental performance, particularly for SMEs, who face more pressure to adopt improved sustainability than large ones. This allows SMEs to improve operational efficiency and increase the firm's reputation and competitive position in a context where the market is developing an increasingly eco-conscious approach.

H4: This finding shows that circular economy practices and environmental performance relate to organizational green culture partially, explained by the beta value of organizational green culture being 0.299 and the t value being 6.185. This first finding suggests that while the Circular Economy Practices directly affect Environmental Performance, part of the effect is mediated by the appearance of a robust organizational green culture. Previous research has continued to demonstrate that organizations that engender a high level of green culture can better sustain the practices particular to the circular economy (Le et al., 2024). SMEs using circular strategies like recycling, waste reduction, and resource efficiency grow as they

not only improve their environmental results directly but also foster an organizational culture in which employees are encouraged to engage in sustainable behaviors. The shift is significant because it empowers employees to become a part of collective responsibility and innovation to help solve environmental problems (Memon & Ooi, 2023). Finally, the outcomes demonstrate that Circular Economy Practices and Organizational Green Culture together can support substantial Environmental Performance improvements, stressing the necessity to include both strategies in the operational practices of SMEs.

Conclusion

Using the Resource View (RBV) theory to frame this study, the interrelationship between Circular Economy Practices, Organizational Green Culture, and Environmental Performance was examined within the manufacturing sector of Pakistani SMEs. In this study, using quantitative research, primary data was collected using well-structured surveys of employees in different SMEs. In this analysis, positive significant relationships between the constructs were found, and key findings were highlighted to highlight the significance of circular economy practices in increasing both the organizational green culture and environmental performance. Importantly, results also showed that the results reveal a significant direct effect of Circular Economy Practices on Environmental Performance. The study also found that Circular Economy Practices vigorously promote an Organizational Green Culture. Moreover, the analysis results indicate a partial mediation effect of Organizational Green Culture on the link between Circular Economy practices and Environmental performance with a beta value of 0.299. However, what becomes apparent from this is the critical role that a strong organizational culture plays in bolstering the positive impact that circular economy strategies can have on a company.

This study contributes to the unique examination of the roles of each of these constructs in a developing country context and to

empirical evidence supporting their interplay. Unlike preceding literature, this study focuses on SMEs' ability to use circular economy initiatives that drive environmental performance and foster a sustainability culture to boost employee engagement and innovation. The findings indicate that it is time for SMEs to embrace circular economy methodologies as integral parts of their operation strategy and a robust green culture. A dual approach using this can enormously improve environmental performance and make SMEs active contributors to sustainable development in Pakistan and the world over.

Managerial Implications

Our study offers several managerial implications for small and medium-sized enterprises (SMEs) in the manufacturing sector. First, managers must see the strategic importance of embedding Circular Economy Practices into their operational systems. SMEs can improve their environmental performance, reduce costs, and improve operational efficiency through practices like recycling, resource efficiency, and waste reduction. In this instance, a proactive approach allows the organization to be seen as a leader in sustainability and, thus, potentially an organization whose competitive advantage increases due to the growing eco-consciousness of the marketplace.

Furthermore, a robust organizational green culture should be nurtured to fully reap the benefits of the circular economy initiative. Therefore, the initiative should come from managers prioritizing initiatives that cultivate this culture, including sustainability workshops, employee engagement activities oriented toward environmental stewardship, and employee training programs. Organizations can promote a shared commitment to sustainability by building this into the organization's core to empower employees to actively participate in green initiatives, be innovative, and be high performers.

The study also emphasizes the importance of leadership that can vigorously champion sustainability efforts. If they are doing it, managers must lead by example and demonstrate their commitment to circular practices and sustainability goals. Additional support for a green culture can also be developed through clear communication around the importance that these practices bring to the organization's sustainability objectives and the part each employee plays in this.

Finally, managers should create circular economy and green culture practices to monitor their effectiveness and create metrics and performance indicators to measure them. However, regular assessments can allow you to identify areas for improvement and help better align the sustainability goals with the company's overarching strategies. If SMEs embrace these managerial implications, they can build a more sustainable operational model that benefits the environment and long-term business success.

Theoretical contribution

This study offers several significant theoretical contributions to understanding sustainability in small and medium-sized enterprises (SMEs) in light of the Resource Based View (RBV) theory. Secondly, it expands the use of RBV by showing how resources can be effectively used to improve Organizational Green Culture and Environmental Performance through Circular Economy Practices. This integration proved that sustainability-related practices were not just operational choices but strategic resources to achieve competitive benefits for SMEs.

Second, the study demonstrates how a supportive cultural environment can buffer the impact of circular economy initiatives in the form of empirical evidence for the mediating role of Organizational Green Culture. This is important as it fills a gap in the existing literature that routinely describes circular economy practices and organizational culture as separate constructs. This research suggests that for organizations to

achieve improved environmental performance, there must first be a focus on implementing circular practices. Secondly, a culture must be encouraged to embrace all stages of sustainability.

Third, the results indicate that SMEs in developing countries present a unique context, therefore adding to the sustainability literature by demonstrating how local factors affect the adoption and execution of circular economy actions and green culture. In this context, i.e., in Pakistan, where SMEs are essential in economic development but have specific challenges in implementing sustainable practices, this issue is very relevant.

This study contributes to the theoretical sustainability discourse by creating a context in which the relationships between Circular Economy Practices, Organization Green Culture, and Environmental Performance in SMEs have been understood in a nuanced manner. Further research endeavors to explore these relationships in other contexts and sectors.

Limitations of study

Despite this contribution, this study has several limitations. While it brings some value in terms of relationships between circular economy practices and organizational green culture and environmental performance, it is subject to certain limitations. The second part focuses specifically on SMEs operating in the manufacturing sector in Pakistan, thus restricting the generalizability of the findings to other sectors or geography. Challenges and opportunities particular to each industry that are excluded from this analysis may vary.

Second, using self-reported data from employee surveys may be biased with social desirability bias, where people may say what they think they should be doing versus what is happening. Therefore, this might distort the data concerning implementing circular economy practices and the power of the organizational green culture.

The study also relies mainly on cross-sectional data describing a snapshot of time. This design prevents the establishment of causal relationships or studying how practices and culture change across time. Future research could benefit from longitudinal studies to further understand how these relationships come to be and under what conditions circular economy practices affect pharmaceutical companies' ability to engage in environmentally responsible production.

Finally, the study finds evidence for partial mediation of Organizational Green Culture but fails to examine other potential mediators or moderators to help explain the complexity of these relationships further. Further research could consider other factors, such as regulatory forces, technological advancement, or engagement of external stakeholders, which may also be involved in this picture.

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