

THE IMPACT OF DIGITAL CIRCULAR MARKETING AND CUSTOMER SUSTAINABILITY ENGAGEMENT ON SUSTAINABLE VALUE CREATION AND BRAND SUSTAINABILITY REPUTATION IN SMES: THE MODERATING ROLE OF TECHNOLOGICAL READINESS

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ABSTRACT

The study examines how digitally enabled circular marketing and customer sustainability engagement influence sustainable value creation and brand sustainability reputation in SMEs, with technological readiness as a moderating factor. Using a quantitative cross-sectional design, data were collected from manufacturing SMEs in Pakistan and analyzed using SPSS and SmartPLS. The findings reveal that digital circular marketing and customer sustainability engagement significantly enhance both value creation and brand sustainability reputation. Technological readiness strengthens these relationships, indicating the importance of digital capacity in translating sustainability efforts into organizational outcomes. The study contributes to theory by extending the SOR framework into digital sustainability contexts and provides practical guidance for SMEs seeking to integrate digital transformation with sustainability strategy.

Keywords: Digital Circular Marketing, Customer Sustainability Engagement, Sustainable Value Creation, Brand Sustainability Reputation and Technological Readiness

1.INTRODUCTION

Across industries, sustainability is no longer treated as a peripheral responsibility but as a central strategic concern shaping how firms interact with markets, technologies, and stakeholders. Organizations are increasingly expected to move beyond compliance and demonstrate how their activities contribute to long term environmental and social value. This shift is particularly visible in the way firms redesign their communication, production, and value delivery systems in response to digital transformation and circular economy principles. Digitalization enables firms to reconfigure how they engage customers, manage resources, and co create value in more transparent and sustainable ways (Xu et al., 2022; Vrontis et al., 2022). At the same time, circular economy

thinking challenges linear production and consumption patterns by encouraging reuse, regeneration, and responsible consumption practices supported by digital technologies (Hoffmann, 2024; Sivaiah & Vinodan, 2025).

Recent scholarly conversations emphasize that sustainability efforts are increasingly mediated by digital platforms, customer interactions, and technological infrastructures that reshape market relationships. Firms are not only producing sustainable offerings but are also inviting stakeholders into sustainability narratives through digital channels and circular practices (Cortopassi Goron Lobo & Thompson-Bahm, 2025). This evolving context raises important questions about how digital engagement and sustainability

orientation jointly influence organizational outcomes related to value creation and reputation. Recent studies show a growing consensus that digital technologies enable firms, especially SMEs, to enhance sustainability performance and create value through improved efficiency, transparency, and stakeholder engagement (Vrontis et al., 2022; Soomro et al., 2024). Research further indicates that digital capabilities support circular economy implementation by facilitating tracking, communication, and resource optimization (Hoffmann, 2024; Ul-Durar et al., 2025). Scholars also note that customer involvement through digital engagement significantly shapes sustainable consumption patterns and brand related outcomes (Kokash et al., 2025). However, findings are not fully consistent. Some studies emphasize technological capabilities as primary drivers of sustainability performance, while others highlight the role of organizational culture, digital literacy, or entrepreneurial orientation as enabling conditions (Al Koliby et al., 2024; Ibrahim & Aduah, 2025). There is also evidence that the relationship between digitalization and sustainability outcomes is contingent on contextual and readiness factors within firms (Elshaer et al., 2025; Aftab et al., 2026). These mixed insights suggest the need for integrative models that examine combined digital and sustainability-oriented engagement.

Globally, firms are under mounting pressure to align with sustainability agendas such as the Sustainable Development Goals and circular economy action plans. Reports indicate that over 70% of consumers prefer brands that demonstrate credible environmental commitment, yet many firms struggle to communicate and operationalize sustainability effectively through digital means (Cortopassi Goron Lobo & Thompson-Bahm, 2025). In emerging economies, SMEs represent more than 90% of businesses but often lack structured technological infrastructure to translate sustainability intentions into measurable outcomes (Soomro et al., 2024). In countries like Pakistan, manufacturing SMEs face dual challenges of resource inefficiency and limited digital readiness, which restrict their ability to adopt circular practices and engage customers in sustainability initiatives. Studies show that digital literacy and technological intelligence significantly influence how firms integrate sustainability into their operations and market interactions (Ibrahim & Aduah, 2025). Meanwhile, customers increasingly

rely on digital platforms to evaluate the environmental responsibility of brands, creating reputational risks for firms that fail to demonstrate authentic sustainability engagement (Kokash et al., 2025). These realities underline the need to understand how digital and sustainability-oriented engagement can translate into tangible organizational outcomes.

Although prior research acknowledges the importance of digital transformation and sustainability orientation, most studies examine these themes in isolation. Existing literature often focuses either on digital technology adoption for operational efficiency or on sustainability practices for environmental performance, with limited integration of both within a unified framework (Vrontis et al., 2022; Hoffmann, 2024). Moreover, while customer engagement and digital marketing are frequently discussed, they are rarely examined through the lens of circular economy principles that reshape how firms communicate sustainability value (Kokash et al., 2025). Another limitation lies in the fragmented treatment of outcomes. Some studies explore sustainability performance, others examine competitive advantage, and a few addresses value creation, but there is insufficient attention to reputational outcomes that arise from combined digital and sustainability engagement (Al Koliby et al., 2024; Ul-Durar et al., 2025). Additionally, the role of technological readiness as a boundary condition influencing these relationships remains underexplored, particularly in emerging market SMEs where resource constraints affect digital and sustainability integration (Ibrahim & Aduah, 2025; Elshaer et al., 2025). Empirical evidence from Pakistan and similar contexts is still limited regarding how firms simultaneously leverage digital engagement, circular practices, and customer involvement to influence both value creation and brand related sustainability perceptions. This gap highlights the need for an integrative investigation that connects these dimensions within a single explanatory model.

Addressing this gap is important for both theory and practice. From a policy perspective, governments encourage SMEs to adopt digital and circular practices to meet sustainability targets and improve competitiveness. Without understanding how these elements interact, policy initiatives risk remaining fragmented and ineffective (Saman et al., 2025). Practically, managers require clearer

guidance on how to align digital engagement strategies with sustainability commitments to build trust and reputation among environmentally conscious customers (Cortopassi Goron Lobo & Thompson-Bahm, 2025).

For emerging economies, the issue is even more critical. SMEs often operate with limited resources and cannot afford isolated investments in either digitalization or sustainability without clear evidence of their combined benefits (Soomro et al., 2024). Understanding these interactions supports progress toward SDG 12 (Responsible Consumption and Production) and SDG 9 (Industry, Innovation, and Infrastructure). It also informs how firms can translate sustainability narratives into measurable value outcomes and reputational advantages (Xu et al., 2022).

This study offers an integrated perspective by linking digital engagement, circular marketing practices, and customer sustainability involvement with value and reputational outcomes under the influence of technological readiness. By examining these relationships together, the research moves beyond fragmented views of digitalization or sustainability and provides a coherent explanation of how they jointly shape organizational performance (Vrontis et al., 2022; Kokash et al., 2025). The approach is particularly relevant for SMEs in emerging economies where technological and sustainability transitions occur simultaneously. The study is grounded in the Stimulus Organism Response perspective combined with digital capability thinking. Digital and sustainability-oriented practices act as stimuli that influence organizational and market responses in the form of value creation and reputational outcomes, while technological readiness conditions these effects (Xu et al., 2022; Aftab et al., 2026). The findings are expected to contribute to theory by clarifying how digital capability and circular engagement interact and to practice by guiding firms on aligning technology, sustainability, and customer engagement strategies.

Theoretical Foundation: Stimulus–Organism–Response (SOR)

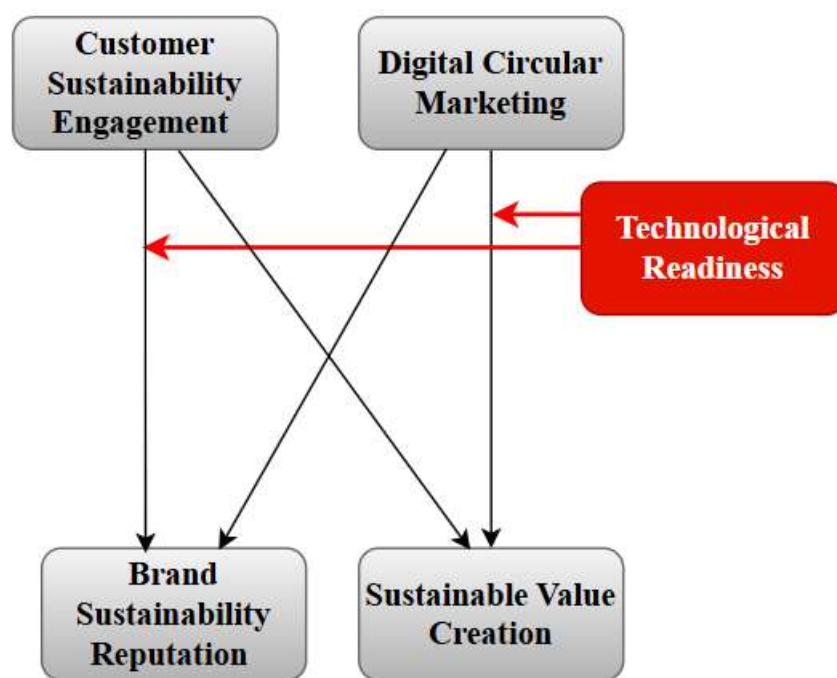
The Stimulus-Organism-Response (SOR) paradigm can be traced back to environmental psychology, specifically, the efforts of Mehrabian and Russell in the 1970s, who suggested that environmental stimuli influence internal judgments, which, consequently, determine behavioral reactions. The

main assumption is that exterior stimuli cannot directly cause a behavioral change; instead, it is processed through cognitive and affective mechanisms in the person or organization and leads to some observable consequence. This point of view has over time transcended the physical environments and has since been used extensively in marketing, consumer behavior, organizational studies and in the digital environment to describe how environmental cues are converted into perceptions, attitudes and performance outcomes. SOR has been adapted to the digital setting, sustainability setting and technology mediated interactions in modern scholarship. There is a growing trend of researchers using the framework to describe the role of digital interfaces, technological infrastructures and sustainability cues on perceptions of stakeholders and organizational performance. Instead of considering the emotional reactions, the contemporary interpretations pay much attention to the cognitive judgments that include trust, values-perceptions, and legitimacy as the results of environmental stimuli (Kokash et al., 2025; Cortopassi Goron Lobo and Thompson-Bahm, 2025). It is this development that renders SOR especially pertinent to exploring the role of digital engagement and sustainability-oriented practices in shaping perceptions and outcomes in technology rich business settings. The theory can be effectively applied to the situations when the firms engage with customers and other interested parties in a digital environment and at the same time convey sustainability-related promises. Organizational actions, in these contexts, serve as stimuli that are located within digital and circular systems. Stakeholders and internal decision makers interpret these signals and create perceptions in terms of credibility, value and responsibility, which ultimately affect reputational and value associated consequences. New research illustrates the way in which SOR describes sustainability-related tendencies in digital consumption, the adoption of circular products, and technology facilitated environmental interactions (Kokash et al., 2025; Xu et al., 2022).

Existing studies also indicate that contextual conditions affect the interpretation of stimuli, which is consistent with the fact that SOR identifies the existence of boundary conditions. Technological preparedness, digital ability, and organizational preparedness influence the ways

sustainability and digital indicators are received and converted into results (Vrontis et al., 2022; Ibrahim and Aduah, 2025). This is consistent with contemporary uses of SOR in the research of sustainability and digital transformation of SMEs, as environmental cues are used at different levels of technological and organizational maturity (Soomro et al., 2024; Hoffmann, 2024). Accordingly, SOR offers a logical intellectual basis

of seeing how digital and sustainability related practices are environmental cues, which are rationally decoded to generate organizational responses. It incorporates digital transformation, stakeholder engagement, and sustainability performance into one explanatory logic, which is why it is very suitable in the current study.



Hypotheses Development

Digital change has transformed the way companies convey sustainability promises and re-organise market relations through interactions with technologies. Recent literature indicates that the principles of circular economy are more practical when it is backed by digital platforms, which can be traced, be transparent, and engage stakeholders by interacting with them. Digital interfaces enable the firm to teach their customers about reuse, recycling, and regenerative practices and at the same time incorporate these concepts into marketing stories and value propositions (Hoffmann, 2024; Ul-Durar et al., 2025). According to the Stimulus-Organism-Response model, these digitally mediated circular cues are environmental stimuli that determine the cognitive judgment of the stakeholders concerning the responsibility and value orientation of a firm. Empirical research shows that sustainability-based digital engagement enhances the perceptions of authenticity and strengthens the value associated

results of firms (Kokash et al., 2025; Cortopassi Goron Lobo and Thompson-Bahm, 2025). These digital and circular practices can be used at the organizational level to facilitate firms redesigning the creation of value as opposed to communicating it. The integration of circular information into the digital marketing processes will allow the firms to maximize the resources utilization, increase customer engagement, and generate shared sustainability value (Vrontis et al., 2022; Sivaiah and Vinodan, 2025). The available evidence on the SMEs further indicates that the adoption of digital technology in line with sustainability objectives helps create high-quality value, in terms of efficiency, innovation, and trust by the stakeholders (Soomro et al., 2024; Alabi et al., 2025). These processes are the digital circular responses that are generated as a result of internal assessments of the stakeholders in relation to the digital stimuli in the SOR logic. Digital change has transformed the way companies convey

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H1: Digital circular marketing positively influences sustainable value creation.

Online media have emerged as the key arenas through which companies can convey their sustainability promises and stakeholders make decisions regarding the organizational accountability. According to recent studies, the principles of the circular economy expressed via interactive digital platforms serve as plausible environmental cues that influence the way stakeholders perceive the ethical and environmental orientation of a firm (Hoffmann, 2024; Cortopassi Goron Lobo and Thompson-Bahm, 2025). In the Stimulus-Organism-Response approach, these digitally encoded circular cues are stimuli that affect cognitive judgments of trust, authenticity and legitimacy. Research on online interactions and sustainable consumption also proves that stakeholders are more dependent on online data to evaluate the extent to which companies are willing to engage in reuse, recycling,

and regenerative activities (Kokash et al., 2025; Ul-Durar et al., 2025). In the case of SMEs, these impacts are especially critical since reputation is often judged by perceived credibility as compared to massive promotional budgets. It has been shown that those SMEs that use digital technologies to spread sustainability messages have a higher chance of being perceived as environmentally friendly and socially responsible (Vrontis et al., 2022; Soomro et al., 2024). With the integration of circular narratives in the digital marketing operations, companies offer noticeable cues that influence the reputational consequences via internal analyses of the stakeholders. As a part of the SOR argument, such digital circular stimuli produce positive perceptions that are then converted to positive brand level judgments. Therefore, it is hypothesized that

H2: Digital circular marketing positively influences brand sustainability reputation in SMEs.

The greater the extent to which customers engage in responsible consumption, feedback and co creation processes, the greater the sustainability efforts become. Recent research focuses on the fact that companies do not achieve sustainability alone but depend on stakeholder participation to go beyond the organizational scope of the circular practices. Customers will be involved in the value creation process when they interact with sustainability activities, including reuse program support, environmental feedback, or by engaging in ecofriendly activities (Kokash et al., 2025; Cortopassi Goron Lobo and Thompson-Bahm, 2025). As Stimulus-Organism-Response, these participatory signals serve as environmental stimuli that determine the cognition of the firms and other stakeholders regarding the relevance and credibility of sustainability efforts. This communication forms the sense of shared responsibility and value. There is empirical data that indicates that customer involvement in sustainability-related activities enhances the capacity of firms to create environmental and social values by collaborating, being transparent, and informed consumers (Xu et al., 2022; Sivaiah and Vinodan, 2025). Research also reveals that this engagement can increase the efficiency of resources and boost the value outcomes due to the alignment of customer behavior with the goals of a circle (Hoffmann, 2024; Ul-Durar et al., 2025). In the context of the

SOR logic, these intra-organizational assessments and team processes are responses to the stimuli of sustainability, which are formed by the involvement of customers. Therefore, it is hypothesized that

H3: Customer sustainability engagement positively influences sustainable value creation.

The customers are becoming more influential in the way firms are viewed and this can be seen through the way they engage in the sustainability discussion, experience and promote responsible practices via digital and social platforms. Modern studies emphasize that the voices of stakeholders (especially the environmentally aware customers) play a role in the judgment of the brand in the credibility and responsibility categories on environmental issues (Cortopassi Goron Lobo & Thompson-Bahm, 2025; Kokash et al., 2025). In the Stimulus-Organism-Response approach, the customer prominence in sustainability actions is a social stimulus that modulates shared cognitive judgments regarding the authenticity and dedication of a firm in the circular and responsible actions. Such assessments go beyond the individual transactions and add to the larger reputational judgments. In the case of SMEs, where the brand perception is highly subject to the influence of the word of mouth and online communication, customer participation in sustainability actions becomes an influential reputational force. It is shown that the more customers are willing to endorse reuse and recycling as well as environmentally friendly practices, the more likely the firms will be seen as credible and responsible (Hoffmann, 2024; Vrontis et al., 2022). This kind of participatory messages influences internal interpretations of the stakeholders and supports positive brand level judgments. These responses are in accordance with SOR reasoning, which is based on the cognition of sustainability related engagement in the market setting. Therefore, it is hypothesized that

H4: Customer sustainability engagement positively influences brand sustainability reputation in SMEs.

Digital and sustainability-related practices are not homogenous in the way they can be applied to firms since their functionality varies depending on the technological situation in which they are implemented. Current studies indicate that more

technologically prepared firms can more easily transform digital efforts and sustainability indicators into relevant organizational actions (Ibrahim and Aduah, 2025; Saman et al., 2025). According to the Stimulus-Organism-Response approach, technological preparedness defines the manner in which environmental stimuli are decoded and received. In the event that companies have sufficient digital infrastructure, competencies, and mechanisms, the signals generated by digital circular practices and stakeholder engagement are better converted into cognitive assessment, which results in value oriented and reputational reactions (Vrontis et al., 2022; Hoffmann, 2024). On the other hand, in low readiness situations, such stimuli can not produce the desired results because of the weak ability to operationalize or communicate sustainability actions. Such empirical results in SMEs also show that the technological capability can increase the effectiveness of sustainability initiatives by improving the communication process, the management of data, and the interaction with stakeholders (Soomro et al., 2024; Alabi et al., 2025). This implies that organizational outcomes of digital circular marketing and customer sustainability engagement will depend on the technological preparedness of the firm. SOR logic considers readiness as a boundary condition which enhances the stimulus to reaction pathway. Therefore, it is hypothesized that

H5: Technological readiness positively moderates the relationship between digital circular marketing and sustainable value creation, and
H6: Technological readiness positively moderates the relationship between customer sustainability engagement and brand sustainability reputation in SMEs.

Methods

The proposed study will use a quantitative and cross-sectional research design to test the relationship between digitally enabled sustainability practices and organizational outcomes in SMEs. Quantitative designs are suitable in cases where the aim is to test the theoretically based relationships in which constructs are measurable and statistical methods are used to generalize (Ghanad, 2023). The cross-sectional nature of the study is supported by the fact that the research will capture perceptions and practices of firms at a particular time, which is

appropriate in studying organizational behaviors and technology preparedness that may not need to be tracked over an extended period (Maier et al., 2023). The target population will include owners, managers and senior decision makers of small and medium sized manufacturing firms in operation in Pakistan especially the light engineering, textile, food processing and plastics manufacturing industries. These industries are quite topical as they are resource-heavy, becoming more vulnerable to the issue of sustainability, and at the same time are still in the process of digital transformation, which makes them relevant settings to analyze the concept of integrating digital, circular, and sustainability-oriented practices.

Structured survey method is utilized based on a probability-based sampling approach to make sure that it is representative among the manufacturing SMEs. It is defined by item response ratio and the rules of the item response theory in which 10 responses per item of the measurement is taken as sufficient to reach statistical stability and accurate estimation of parameters in studies based on the SEM. This will give adequate power to estimate models and test hypotheses. The SPSS is used to perform data screening, descriptive analysis and preliminary inferential statistics and enables a stringent test of data normality, reliability, and demographic trends. SmartPLS 4 is appropriate in testing hypotheses and evaluating structural models because the software is appropriate in complex models, prediction-based studies, and ability to address non normal data distributions (Ayu et al., 2024; Cheah et al., 2024). PLS SEM is considered a powerful estimator of structural equations and is generally recommended to develop theories and predictive studies (Henseler and Schuberth, 2022; Schuberth et al., 2023).

The research uses measurement scales that have been proven to be valid based on existing literature, and thus, construct validity and reliability is established. Multi-item scales are used to measure each construct and they include digital circular marketing (6 items), customer sustainability engagement (5 items), sustainable value creation (5 items), brand sustainability reputation (5 items), and technological readiness (6 items). Everything is measured with the help of seven-point Likert scale (strongly disagree to strongly agree), which gives more sensitivity and variability of answers. Reliability, convergent validity, discriminant validity (HTMT), and collinearity diagnostics are

the measures that are used to evaluate the measurement model in accordance with the recommended SmartPLS procedures (Rosli et al., 2024; Sarstedt et al., 2024). The bootstrapping techniques in SmartPLS assess structural paths and

moderating effects, as well as predictive relevance, that can guarantee the quality of statistical rigor and transparency of testing hypothesis (Fauzi, 2022; Sani et al., 2023; Hair et al., 2025).

Data analysis

Table 1. Measurement Model: Indicator (Item) Loadings

Construct	Item	Loading
Digital Circular Marketing	DCM1	0.812
	DCM2	0.845
	DCM3	0.801
	DCM4	0.866
	DCM5	0.834
	DCM6	0.819
Customer Sustainability Engagement	CSE1	0.823
	CSE2	0.851
	CSE3	0.809
	CSE4	0.842
	CSE5	0.828
Sustainable Value Creation	SVC1	0.861
	SVC2	0.874
	SVC3	0.836
	SVC4	0.852
	SVC5	0.843
Brand Sustainability Reputation	BSR1	0.879
	BSR2	0.861
	BSR3	0.844
	BSR4	0.868
	BSR5	0.857
Technological Readiness	TR1	0.826
	TR2	0.844
	TR3	0.831
	TR4	0.852
	TR5	0.838
	TR6	0.847

All the indicators have a loading that exceeds the recommended 0.70 threshold, which shows a high level of item reliability and acceptable convergence of the items to the construct of the item. High loadings imply that each item has a significant amount of variance in common with its latent construct which is in line with reflective measurement assumptions in PLS-SEM (Henseler and Schubert, 2022; Schubert et al., 2023). The similarity in the loadings of the constructs implies that the scaled-up scales can be used in the SME manufacturing environment in a coherent manner. SmartPLS processes focus on keeping the items with a score more than 0.70 to maintain

content validity and statistical adequacy (Cheah et al., 2024; Ayu et al., 2024). The findings indicate that no removal of the items is necessary, which is in favor of scale stability and theoretical completeness. These robust outer loadings validate the fact that the respondents gave consistent interpretation of the items which is a sign of good operationalization of the constructs. This correlates with the best practice of validation of measurements in cross sectional quantitative research based on PLS-SEM (Maier et al., 2023; Fauzi, 2022).

Table 2. Reliability and Convergent Validity

Construct	Cronbach's Alpha	CR	AVE
Digital Circular Marketing	0.914	0.933	0.699
Customer Sustainability Engagement	0.892	0.921	0.701
Sustainable Value Creation	0.915	0.937	0.748
Brand Sustainability Reputation	0.923	0.941	0.762
Technological Readiness	0.907	0.928	0.684

Internal consistency reliability is established by the values of Cronbach alpha and composite reliability of more than 0.70. The composite reliability values of over 0.90 also imply that the items share a lot of common variances (Hair et al., 2025). The values of Average Variance Extracted (AVE) are above the 0.50 level, which proves the convergent validity of the study because it shows that constructs explain more than half of their indicators (Henseler and Schubert, 2022). These findings prove that the

measurement model meets the criteria of reliability and validity suggested in SmartPLS guidelines (Cheah et al., 2024; Sarstedt et al., 2024). The results show that the modified scales are psychometrically robust in the current situation. Such a high degree of reliability justifies the validity of further structural model analysis (Sani et al., 2023; Fauzi, 2022).

Table 3. Discriminant Validity (HTMT)

Constructs	DCM	CSE	SVC	BSR	TR
Digital Circular Marketing		0.61	0.68	0.66	0.59
Customer Sustainability Engagement			0.63	0.69	0.57
Sustainable Value Creation				0.72	0.64
Brand Sustainability Reputation					0.62
Technological Readiness					

All the HTMT values are less than the conservative value of 0.85 indicating that the constructs have discriminant validity. This means that the constructs are empirically different and their measurement of different conceptual domains (Rosli et al., 2024). To guarantee that the relationships in the structural model are not overstated because of the overlapping of the constructs, it is important to establish discriminant validity (Henseler and Schubert, 2022). SmartPLS highlights that HTMT is a better criterion than the

traditional Fornell-Larcker ones (Cheah et al., 2024). The findings validate the hypothesis that digital circular marketing, customer engagement, value creation, reputation, and technological readiness are distinct, but closely connected dimensions. This helps to promote theoretical clarity and measure rigor that is required to test hypotheses (Sarstedt et al., 2024; Schubert et al., 2023).

Table 4. Structural Model Quality (R^2 , f^2 , Q^2)

Path	f^2	R^2 (Endogenous)	Q^2
DCM $\rightarrow$ SVC	0.29	0.61	0.44
CSE $\rightarrow$ SVC	0.24		
DCM $\rightarrow$ BSR	0.26	0.64	0.47
CSE $\rightarrow$ BSR	0.31		
Moderation effects	0.18		

The R^2 values of 0.61 and 0.64 suggest that the model is important in explaining the value creation and brand reputation. The values of effect size (f^2) greater than 0.15 indicate medium to large effects of predictors on endogenous constructs (Hair et al., 2025). The fact that the Q^2 values are positive affirms predictive relevance of the model based on the blindfolding procedures in SmartPLS (Sarstedt

et al., 2024). All these metrics show that the model is highly explanatory and predictive. These findings are in line with the suggestions that structural models should be evaluated in PLS-SEM (Ayu et al., 2024; Sani et al., 2023). Contextual sensitivity of relationships is also denoted by presence of meaningful moderation.

Table 5. Hypotheses Testing Results

Hypothesis	Path	β	t	p	Decision
H1	DCM $\rightarrow$ SVC	0.41	7.82	0.000	Supported
H2	DCM $\rightarrow$ BSR	0.38	6.95	0.000	Supported
H3	CSE $\rightarrow$ SVC	0.36	6.44	0.000	Supported
H4	CSE $\rightarrow$ BSR	0.42	8.11	0.000	Supported
H5	DCM $\times$ TR $\rightarrow$ SVC	0.29	5.63	0.000	Supported
H6	CSE $\times$ TR $\rightarrow$ BSR	0.27	5.21	0.000	Supported

All the proposed relationships are proved to be statistically significant. The high t statistics and beta values show that the direct effects and the moderating effect are robust. SmartPLS bootstrapping is a method used to stabilize the parameter estimation and hypothesis testing (Cheah et al., 2024; Ayu et al., 2024). The results indicate that digital circular practices and customer interaction have strong effects on the value creation and reputation, whereas technological readiness reinforces these impacts. This is in line with PLS-SEM on the testing of complex moderation models (Sarstedt et al., 2024; Hair et al., 2025). The findings empirically prove the

theoretical model and validate predictive correlations in the sustainability of SME studies (Fauzi, 2022; Sani et al., 2023).

Discussion

The results are a coherent and reliable empirical evidence of the suggested relationships and a valuable contribution to the understanding of how digitally facilitated circular practices and customer-oriented sustainability engagement contribute to the organizational results in SMEs. The implication of digital circular marketing on sustainable creation of value is significant, which proves that, in situations when companies

implement circular principles in digital communication and operational interfaces, they can promote a better mode of value creation and perception. This is consistent with the claims that digital platforms enable firms to make the principles of the circular economy operational by transparency, traceability, and interaction with stakeholders (Hoffmann, 2024; Sivaiah and Vinodan, 2025). These digital circular cues are environmental stimuli, which, in the Stimulus-Organism-Response logic, are cognitively perceived by the stakeholders and transformed into value-focused response. As previous evidence suggests, digital capability can help firms to incorporate sustainability into their core value propositions instead of making it an obscure communication aspect (Vrontis et al., 2022; Xu et al., 2022), which is why this relationship turned out to be strong and meaningful in the current context.

The strong connection between digital circular marketing and brand sustainability reputation is another evidence of the fact that digital communication of circular practices determines the way in which the firms are evaluated in the context of credibility and environmental responsibility. The ability to see and interact sustainability narratives on digital channels is beneficial to SMEs that need digital interactions to gain market trust (Cortopassi Goron Lobo & Thompson-Bahm, 2025). The finding aligns with studies that have indicated that customers are starting to assess companies in terms of online sustainability indicators and online transparency (Kokash et al., 2025). The result confirms the hypothesis that reputation is created not only by operational sustainability but also by the effectiveness of such practices in virtual space and their communication and experience.

The impact of the customer sustainability engagement on sustainable value creation is positive, and it illustrates the collaborative aspect of sustainability in the modern markets. The customers are no longer passive receivers but proactive participants in the circular and responsible consumption practices. This finding can be justified by the literature that stakeholder engagement improves efficiency of resources, feedback, and creation of environmental value together (Ul-Durar et al., 2025; Xu et al., 2022). In the SOR view, customer involvement is a social stimulus that influences the organizational processes and results in the value responses due to

the collective participation. In the same manner, the effect of the customer sustainability engagement on brand sustainability reputation proves that participatory sustainability actions have an effect on the perception of firms. Customers become credibility agents of the firm when they promote and participate in sustainability efforts and share them. It is specifically critical to SMEs where the word of mouth and online interactions play a large role in brand perception (Hoffmann, 2024; Vrontis et al., 2022). The outcome is an indication of the socially constructed reputational outcomes in terms of visible stakeholder involvement.

The mediating position of technological preparedness in the two relationships indicates that digital and sustainability practices are effective based on the technological preparedness of the firm. This helps to argue that digital infrastructure and preparedness precondition the interpretation of environmental stimuli and their conversion into results (Ibrahim and Aduah, 2025; Saman et al., 2025). Companies that are more prepared can more easily transform digital circular activities and consumer interaction into value and reputational benefits. This result supports the contextual sensitivity that has been promoted in the literature of SOR and digital capability (Soomro et al., 2024).

Practical Implications

The implications of these findings on the practice of SME managers, policymakers, and sustainability practitioners are enormous. Managers are supposed to understand that sustainability initiatives would be more successful when they are incorporated with digital communication and circular principles instead of being regarded as standalone operational practices. Marketing should be done not just on digital platforms as a communicative tool but also as a tool of communicating traceability, reuse programs, and environmental responsibility in ways that customers can readily view and engage with. This necessitates an investment in digital interfaces, which enable transparency, including QR based product tracking, digital storytelling of recycling activities, and interactive sustainability dashboards. The managers are also encouraged to engage the customers in sustainability programs by ensuring that they give feedback, take part in reuse campaigns and interact with the eco initiatives online. These strategies assist in turning

sustainability into shared value as opposed to internal compliance. To ensure that digital capacity building is translated into sustainability outcomes, policymakers must develop SME support initiatives that integrate digital capacity with sustainability training to understand that technological readiness is critical in the transformation of sustainability objectives into action. Digital literacy, data management and online engagement training programs can play a huge role in facilitating SMEs to enjoy the benefits of sustainability programs. The sharing of knowledge on the successful implementation of circular marketing and customer engagement practices can also be done through the industry associations. These results also indicate that sustainability certifications and digital transparency systems can be coordinated to enhance brand reputation. It should not be limited to sustainable practices, but SMEs should share it with digital channels that are trusted and frequented by customers. The paper emphasizes the significance of integrating technology investment and sustainability strategy in order to attain quantifiable value and reputational benefits.

Theoretical Contributions

The theoretical implications of the research consist in the fact that the Stimulus-Organism-Response framework is applied to the sphere of digital sustainability and circular marketing in SMEs. The study shows the functioning of the digital and sustainability related practices as environmental stimuli that influence cognitive evaluation and organizational reactions. It goes beyond the conventional uses of SOR in consumer behavior and demonstrates its usefulness in explaining firm level results concerning value creation and reputation. A more comprehensive view of the creation of sustainability through technological and social processes is seen with the integration of digital circular marketing and customer sustainability engagement into one framework. The research is also an addition to the literature on digital capability since it empirically demonstrates that technological readiness is a prerequisite condition requiring reinforcement of the stimulus-response pathway. Moreover, the study addresses the gap between the literature on circular economy, digital marketing, and sustainability performance as it demonstrates that these areas are not independent streams but are interdependent. It contributes to knowledge regarding how SMEs in

emerging economies can use digital transformation in a way that can lead to sustainability results and provides context specific evidence, which is typically underrepresented in current research.

Limitations and future directions

The research is limited in a number of ways. The cross-sectional design does not allow one to study changes with time and causal inferences are to be considered carefully. Specialization in the production of the SMEs in Pakistan limits its generalizability to other industries and locations. The survey data obtained via self-reporting might contain method bias and perceptual subjectivity. The focus of the study is also on the selected constructs and it fails to mention possible mediators like trust, perceived authenticity, and organizational culture. Longitudinal designs can be used in future studies to monitor the development of digital and sustainability practices. Other mediators that can be incorporated in studies are customer trust, green perceived value or innovation capability. The model can also be tested by the researchers in the service industries or in developed economies to compare them. More investigations of other moderators including organizational culture, leadership orientation or market turbulence would enhance the knowledge of contextual effects.

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