

Managing Change for Sustainability: An Integrated Model of Digital Capability, Leadership, Culture, and Employee Engagement

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Abstract

Drawing upon the Dynamic Capabilities Theory and Transformational Leadership Theory, this research proposes a conceptual framework that integrates technological, human, and cultural dimensions of organizational change toward sustainability. Using a quantitative research design, data were collected from 385 managers and employees across various industries implementing sustainability initiatives. The hypothesized relationships were tested using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0. The structural model results revealed that digital transformation capability, leadership commitment, and organizational culture for sustainability significantly influence change readiness. Similarly, these independent variables showed significant positive effects on employee engagement. Furthermore, both change readiness and employee engagement demonstrated strong positive relationships with sustainability performance. Mediation analysis confirmed the indirect effects, with change readiness and employee engagement serving as significant mediators in the relationships between the independent variables and sustainability performance. This study contributes to the existing literature by providing an integrated framework that highlights the critical role of change readiness and employee engagement in translating organizational capabilities and leadership commitment into tangible sustainability outcomes. The findings offer practical implications for managers seeking to enhance sustainability performance through effective change management strategies.

Keywords: *Sustainability Performance, Change Management, Digital Transformation, Leadership Commitment, Organizational Culture, Change Readiness, Employee Engagement.*

Introduction

The contemporary business landscape is characterized by unprecedented environmental challenges, stakeholder demands for corporate responsibility, and regulatory pressures that compel organizations to integrate sustainability into their core strategic framework (Ellili, 2024). As climate change accelerates and resource scarcity becomes increasingly pronounced, the imperative for organizations to adopt sustainable practices has transcended mere corporate social responsibility and evolved into a fundamental business necessity (Dzhengiz, 2020). This transformation requires organizations to fundamentally reconfigure their operations, strategies, and cultural orientations, necessitating comprehensive change management approaches that can effectively navigate the complexities of sustainability transitions (Smith, 2012). The integration of sustainability into organizational practices represents one of the most significant transformational challenges faced by modern enterprises. Unlike conventional organizational changes that may focus on incremental improvements or operational adjustments, sustainability-oriented transformation demands a fundamental reconceptualization of value creation, stakeholder relationships, and long-term strategic orientation (Tardin et al., 2024). This profound nature of sustainability transformation underscores the critical importance of understanding the antecedents, processes, and mechanisms that facilitate successful organizational change toward sustainability objectives (Mohd Zawawi & Abd Wahab, 2019).

Digital transformation has emerged as a pivotal enabler of sustainability initiatives, offering organizations unprecedented capabilities to monitor, analyze, and optimize their environmental and social impacts (Carayannis et al., 2015). The convergence of digital technologies such as artificial intelligence, Internet of Things, big data analytics, and cloud computing provides organizations with powerful tools for enhancing resource efficiency, reducing waste, and enabling circular economy models (Braccini & Margherita, 2018). However, the mere adoption of digital technologies does not guarantee sustainability outcomes; rather, organizations must develop sophisticated digital transformation capabilities that can effectively leverage these technologies in service of sustainability objectives. Leadership commitment represents another critical factor in sustainability-oriented change management. The role of organizational leaders in championing sustainability initiatives, allocating resources, and modeling sustainable behaviors cannot be overstated. Transformational leaders who can articulate a compelling vision of sustainability, inspire organizational members, and create supportive contexts for change are essential for successful sustainability transformation (Amjad et al., 2021). The commitment of top management sends powerful signals throughout the organization regarding the priority and legitimacy of sustainability efforts (Amui et al., 2017).

Organizational culture serves as the bedrock upon which sustainability initiatives are built and sustained. A culture that values environmental stewardship, social responsibility, and long-term thinking creates the necessary conditions for sustainability practices to take root and flourish (Galpin et al., 2015). However, transforming organizational culture is inherently challenging, as it involves reshaping deeply held assumptions, values, and behavioral norms that have developed over extended periods. Understanding how organizational culture for sustainability

influences change processes and outcomes is therefore essential for effective sustainability management (Baumgartner & Rauter, 2017). Change readiness and employee engagement represent critical mediating mechanisms that translate organizational capabilities, leadership commitment, and cultural orientations into tangible sustainability performance (Rahi et al., 2022). Change readiness reflects the extent to which organizational members are psychologically and behaviorally prepared to embrace and support sustainability initiatives. Employee engagement captures the degree to which employees are emotionally invested in and committed to sustainability objectives. Together, these mediating variables help explain how organizational inputs are transformed into sustainability outcomes through the active involvement and commitment of organizational members (Zulkarnain et al., 2024).

Despite the growing recognition of these factors' importance, existing research has largely examined them in isolation, leaving significant gaps in our understanding of how they interact and combine to produce sustainability performance. This study addresses these gaps by developing and empirically testing an integrated sustainability-oriented change management model that examines the direct and indirect effects of digital transformation capability, leadership commitment, and organizational culture for sustainability on sustainability performance, with change readiness and employee engagement serving as mediating mechanisms.

Theoretical Foundations

This study draws upon three complementary theoretical perspectives that provide a robust foundation for understanding sustainability-oriented change management: Dynamic Capabilities Theory, Transformational Leadership Theory, and the Theory of Planned Behavior. Each theory contributes unique insights that, when integrated, offer a comprehensive framework for examining the complex relationships among organizational capabilities, leadership, culture, and sustainability performance.

Dynamic Capabilities Theory

Dynamic Capabilities Theory, originally developed by Teece, Pisano, and Shuen (1997), provides a powerful lens for understanding how organizations achieve and sustain competitive advantage in rapidly changing environments. The theory posits that in dynamic markets, competitive advantage derives not merely from the possession of valuable resources but from the organization's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments (Laaksonen & Peltoniemi, 2018). This perspective is particularly relevant to sustainability transformation, which requires organizations to continuously adapt their resource configurations in response to evolving environmental challenges and stakeholder expectations.

Digital transformation capability represents a specific manifestation of dynamic capabilities in the context of sustainability. As organizations seek to leverage digital technologies for sustainability purposes, they must develop the capacity to sense opportunities for digital-enabled sustainability improvements, seize these opportunities through appropriate investments and initiatives, and transform their organizational

configurations to realize the potential benefits (Pisano, 2017). This sensing-seizing-transforming framework provides a structured approach to understanding how organizations can build and deploy digital transformation capabilities in service of sustainability objectives.

The application of Dynamic Capabilities Theory to sustainability contexts has gained increasing attention in recent scholarship. Researchers have argued that sustainability represents a domain where dynamic capabilities are particularly important, given the complex, uncertain, and rapidly evolving nature of environmental and social challenges (Salvato & Vassolo, 2018). Organizations that can effectively develop and deploy dynamic capabilities for sustainability are better positioned to anticipate regulatory changes, respond to stakeholder pressures, and capitalize on emerging opportunities for sustainable value creation.

Transformational Leadership Theory

Transformational Leadership Theory, as articulated by Bass (1985) and Burns (1978), provides a compelling framework for understanding how leaders can inspire and motivate organizational members to pursue extraordinary outcomes. Transformational leaders are characterized by their ability to articulate a compelling vision, inspire followers to transcend self-interest, provide intellectual stimulation, and offer individualized consideration (Kwan, 2020). These leadership behaviors are particularly relevant to sustainability transformation, which requires organizational members to embrace new values, adopt new behaviors, and commit to challenging long-term objectives. The role of transformational leadership in organizational change has been extensively documented in the literature. Transformational leaders create a sense of urgency and purpose around change initiatives, helping organizational members understand the importance and necessity of transformation (Siangchokyoo et al., 2020). They model the behaviors they expect from others, demonstrating through their own actions the commitment and engagement required for successful change. They also create supportive environments that encourage experimentation, learning, and growth during the change process.

In the specific context of sustainability, transformational leadership takes on additional significance. Sustainability transformation requires organizational members to adopt new ways of thinking about the relationship between business and society, to embrace longer time horizons, and to consider broader stakeholder interests (Turnnidge & Côté, 2018). Transformational leaders are uniquely positioned to facilitate this cognitive and behavioral transformation by articulating a compelling sustainability vision, connecting individual actions to broader societal impacts, and inspiring commitment to sustainability objectives (Eaton et al., 2024).

This study draws upon Transformational Leadership Theory to understand how leadership commitment influences the change process and sustainability outcomes. The theory suggests that leaders who demonstrate strong commitment to sustainability will be more effective at creating change readiness among organizational members and fostering the employee engagement necessary for successful sustainability

transformation. This theoretical foundation underpins the hypothesized relationships between leadership commitment and the mediating and outcome variables in our model.

Digital Transformation Capability

Digital transformation capability has emerged as a critical organizational competence in the contemporary business environment. Defined as the organization's ability to leverage digital technologies to fundamentally transform business processes, models, and customer experiences, digital transformation capability encompasses technological, organizational, and strategic dimensions (Yu et al., 2022). In the context of sustainability, digital transformation capability enables organizations to enhance their environmental monitoring, optimize resource utilization, and develop innovative solutions to sustainability challenges (Mele et al., 2024). The concept of digital transformation capability builds upon the resource-based view of the firm and dynamic capabilities theory. From a resource-based perspective, digital technologies and the capabilities to deploy them effectively represent valuable, rare, inimitable, and non-substitutable resources that can provide competitive advantage (Ghosh et al., 2022). The dynamic capabilities perspective emphasizes that the value of these resources lies not merely in their possession but in the organization's ability to continuously adapt and reconfigure them in response to changing environmental conditions (Li et al., 2018). Research has identified several key dimensions of digital transformation capability. Technological infrastructure represents the foundation, encompassing the hardware, software, and network resources that enable digital operations. Data analytics capability reflects the organization's ability to collect, process, and derive insights from large volumes of data (Ellström et al., 2022). Digital integration capability refers to the ability to connect and coordinate digital systems across organizational boundaries. Digital innovation capability captures the organization's capacity to develop and implement novel digital solutions. Together, these dimensions constitute a comprehensive digital transformation capability that can be leveraged for sustainability purposes.

Leadership Commitment

Leadership commitment to sustainability represents one of the most critical factors in successful sustainability transformation. The commitment of organizational leaders sends powerful signals throughout the organization regarding the importance and legitimacy of sustainability initiatives (Yahaya & Ebrahim, 2016). Leaders who demonstrate genuine commitment to sustainability through their words, actions, and resource allocation decisions create the conditions necessary for organizational members to embrace sustainability-oriented change. The concept of leadership commitment encompasses multiple dimensions. Cognitive commitment reflects leaders' genuine belief in the importance of sustainability and their understanding of its strategic implications for the organization. Affective commitment captures the emotional connection leaders feel toward sustainability objectives and their passion for creating positive environmental and social impacts (Terlav et al., 2016). Behavioral commitment manifests in the concrete actions leaders take to support sustainability,

including resource allocation, policy development, and personal modeling of sustainable behaviors.

Transformational leadership theory provides a useful framework for understanding how leadership commitment influences sustainability outcomes. Transformational leaders articulate a compelling vision of sustainability that inspires organizational members and creates a sense of shared purpose. They challenge existing assumptions and encourage creative thinking about how sustainability can be integrated into organizational practices (Cilek, 2019). They provide individualized support and recognition to help organizational members develop the capabilities and motivation needed for sustainability transformation. Through these behaviors, transformational leaders create the conditions for successful sustainability-oriented change.

Organizational Culture for Sustainability

Organizational culture for sustainability refers to the shared values, beliefs, assumptions, and behavioral norms within an organization that support and reinforce sustainability-oriented thinking and action (Galpin et al., 2015). A strong organizational culture for sustainability creates an environment where environmental and social considerations are integrated into decision-making processes, where sustainable behaviors are expected and rewarded, and where organizational members feel a collective responsibility for sustainability outcomes. The concept of organizational culture for sustainability builds upon the broader organizational culture literature while introducing specific content related to environmental and social responsibility. Schein's (2010) model of organizational culture, which distinguishes among artifacts, espoused values, and underlying assumptions, provides a useful framework for understanding sustainability culture. At the artifact level, sustainability culture manifests in visible symbols, rituals, and practices related to sustainability. At the values level, it reflects the explicit commitments and priorities expressed by the organization. At the assumptions level, it encompasses the deeply held beliefs about the relationship between the organization and its natural and social environment (Assoratgoon & Kantabutra, 2023).

Research has identified several key dimensions of organizational culture for sustainability. Environmental values reflect the priority placed on environmental stewardship and ecological responsibility. Social values capture the emphasis on social equity, community welfare, and stakeholder well-being (Isensee et al., 2020). Long-term orientation reflects the extent to which the organization prioritizes long-term sustainability over short-term gains. Stakeholder focus captures the breadth of organizational concern beyond shareholders to include employees, customers, communities, and the environment. Together, these dimensions constitute a comprehensive culture for sustainability that shapes organizational thinking and behavior.

Change Readiness

Change readiness refers to the extent to which organizational members are psychologically and behaviorally prepared to implement and support organizational change initiatives. It encompasses cognitive, emotional, and behavioral components that collectively determine how organizational members respond to change (Shah et al., 2017). In the context of sustainability transformation, change readiness reflects organizational members' preparedness to embrace new sustainability practices, adopt new ways of thinking about organizational responsibilities, and support the changes necessary to achieve sustainability objectives. The concept of change readiness has evolved significantly in the organizational change literature. Early conceptualizations focused primarily on resistance to change, viewing change readiness as the absence of resistance. More recent perspectives recognize change readiness as a positive state characterized by active preparation for and commitment to change (Salahat et al., 2023). This shift reflects a broader evolution in change management thinking from viewing change as something done to organizational members to viewing change as a collaborative process in which members are active participants.

Research has identified multiple dimensions of change readiness. Cognitive readiness reflects organizational members' understanding of the need for change and their belief that the proposed change is appropriate and necessary. Emotional readiness captures the positive affective orientation toward change, including enthusiasm, optimism, and reduced anxiety (Huntingford et al., 2019). Behavioral readiness manifests in the intention and preparation to engage in change-related behaviors. Together, these dimensions provide a comprehensive picture of organizational members' preparedness for change.

Employee Engagement

Employee engagement has emerged as a critical construct in organizational research and practice, reflecting the extent to which employees are emotionally, cognitively, and behaviorally invested in their work and their organization (Eldor & Vigoda-Gadot, 2017). Engaged employees demonstrate high levels of energy, dedication, and absorption in their work, going beyond minimum requirements to contribute to organizational success. In the context of sustainability, employee engagement captures the degree to which employees are committed to and actively involved in achieving sustainability objectives. The concept of employee engagement builds upon earlier constructs such as job satisfaction and organizational commitment while introducing unique elements. Unlike job satisfaction, which focuses primarily on affective responses to work, engagement encompasses both emotional and behavioral components (Kumar & Pansari, 2015). Unlike organizational commitment, which emphasizes attachment to the organization, engagement emphasizes active involvement in work activities. This distinctive focus on energy, dedication, and absorption makes engagement particularly relevant to understanding how employees contribute to organizational objectives such as sustainability performance.

Research has identified multiple dimensions of employee engagement. Emotional engagement reflects the positive feelings employees experience in relation to their work, including enthusiasm, pride, and inspiration (Chanana & Sangeeta, 2021). Cognitive

engagement captures the level of mental investment employees make in their work, including their focus, attention, and concentration. Behavioral engagement manifests in the discretionary effort employees put into their work, including going beyond job requirements and persisting in the face of challenges. Together, these dimensions provide a comprehensive picture of employee engagement.

Sustainability Performance

Sustainability performance refers to the extent to which an organization achieves its environmental, social, and economic objectives in a balanced and integrated manner. It encompasses the triple bottom line of people, planet, and profit, recognizing that long-term organizational success requires attention to all three dimensions (Morioka & de Carvalho, 2016). Sustainability performance represents the ultimate outcome of interest in this study, reflecting the effectiveness of organizational efforts to integrate sustainability into core business practices. The measurement of sustainability performance has evolved significantly in recent decades. Early approaches focused primarily on environmental performance, measuring indicators such as energy consumption, waste generation, and emissions. The introduction of the triple bottom line framework expanded the scope to include social and economic dimensions (Hussain et al., 2018). More recent approaches emphasize the integration of sustainability into core business strategy and the creation of shared value for multiple stakeholders. This evolution reflects growing recognition that sustainability is not merely about reducing negative impacts but about creating positive value for society and the environment.

Research has identified multiple dimensions of sustainability performance. Environmental performance encompasses outcomes related to resource efficiency, pollution prevention, biodiversity conservation, and climate change mitigation (Naciti, 2019). Social performance includes outcomes related to employee well-being, community development, customer satisfaction, and supply chain responsibility. Economic performance captures the financial sustainability of the organization, including profitability, growth, and long-term viability. The integration of these dimensions reflects the recognition that true sustainability requires balanced attention to all three areas.

Digital Transformation Capability and Change Readiness

Digital transformation capability enhances change readiness by providing organizational members with the tools, information, and confidence needed to embrace sustainability-oriented change (Michelotto & Joia, 2024). Organizations with strong digital transformation capabilities can effectively communicate the rationale and benefits of sustainability initiatives, provide training and support through digital platforms, and create transparency around sustainability performance that builds trust in the change process. Furthermore, the experience of digital transformation itself builds organizational capacity for change, making members more comfortable with the uncertainty and learning requirements associated with sustainability transformation (Sharma et al., 2024).

The theoretical rationale for this relationship is grounded in Dynamic Capabilities Theory, which suggests that organizations with stronger dynamic capabilities are better positioned to adapt to changing environmental conditions (Al-Moaid & Almarhdi, 2024). Digital transformation capability, as a specific form of dynamic capability, enables organizations to sense sustainability opportunities, seize them through appropriate initiatives, and transform their operations accordingly. This adaptive capacity creates confidence among organizational members that the organization can successfully navigate sustainability transformation, enhancing their readiness for change (Ghobakhloo & Iranmanesh, 2021). Empirical evidence supports the positive relationship between technological capabilities and change readiness. Studies have shown that organizations with better technological infrastructure and digital capabilities are more successful in implementing organizational changes, partly because these capabilities enhance communication, training, and support for change (Laaksonen & Peltoniemi, 2018). While research specifically examining the relationship between digital transformation capability and change readiness for sustainability is limited, the theoretical rationale and related empirical evidence support a positive relationship.

H1: Digital transformation capability has a positive and significant effect on change readiness.

Digital Transformation Capability and Employee Engagement

Digital transformation capability contributes to employee engagement by creating meaningful work experiences and providing opportunities for employee development and contribution. Digital tools can enhance the meaningfulness of sustainability work by making visible the connections between individual actions and environmental or social outcomes (Yu et al., 2022). They can provide employees with opportunities to develop new skills and competencies, which enhances their sense of growth and development. They can also enable greater autonomy and flexibility in how work is performed, which supports employee engagement.

The Job Demands-Resources model provides a theoretical foundation for understanding this relationship. According to this model, job resources such as autonomy, feedback, and opportunities for development enhance employee engagement by fulfilling basic psychological needs (Mele et al., 2024). Digital transformation capability creates job resources by providing employees with tools that enhance their autonomy, platforms that facilitate feedback on sustainability performance, and opportunities to develop digital and sustainability-related competencies. These resources contribute to higher levels of employee engagement. Research on the relationship between technology and employee engagement has produced mixed findings, with some studies showing positive effects and others showing negative effects. The key factor appears to be whether technology is implemented in ways that enhance or diminish the quality of work experiences (Li et al., 2018). When digital transformation is implemented with attention to employee needs and with appropriate support and training, it tends to enhance engagement. This study focuses on digital transformation capability, which implies not merely technology

adoption but the organizational capacity to effectively leverage digital technologies, which should be more likely to enhance than diminish engagement.

H2: Digital transformation capability has a positive and significant effect on employee engagement.

Leadership Commitment and Change Readiness

Leadership commitment is a critical driver of change readiness. When leaders demonstrate genuine commitment to sustainability through their words, actions, and resource allocation decisions, they send powerful signals that sustainability transformation is a legitimate organizational priority (Yahaya & Ebrahim, 2016). This signaling effect reduces uncertainty about the importance of sustainability initiatives and creates confidence that the organization will support the change process. Leaders who are committed to sustainability are also more likely to invest in the communication, training, and support activities that build change readiness among organizational members.

Transformational Leadership Theory provides a strong theoretical foundation for understanding this relationship. Transformational leaders create change readiness by articulating a compelling vision that inspires organizational members, by challenging existing assumptions and encouraging new ways of thinking, and by providing individualized support that builds confidence and competence (Terglav et al., 2016). These leadership behaviors are particularly important in the context of sustainability transformation, which requires fundamental shifts in organizational thinking and behavior.

Empirical research has consistently demonstrated the positive relationship between leadership commitment and change readiness across various organizational change contexts. Studies have shown that leader behaviors such as communicating the change vision, modeling desired behaviors, and providing support for change enhance organizational members' readiness to embrace change (Cilek, 2019). In the specific context of sustainability, research has shown that leadership commitment is a critical factor in successful sustainability transformation, influencing both the initiation and implementation of sustainability initiatives.

H3: Leadership commitment has a positive and significant effect on change readiness.

Leadership Commitment and Employee Engagement

Leadership commitment enhances employee engagement by creating meaningful work contexts and demonstrating that employee contributions to sustainability are valued. When leaders are genuinely committed to sustainability, they help employees understand how their work contributes to important environmental and social outcomes, which enhances the meaningfulness of work. They recognize and reward employee contributions to sustainability, which reinforces engagement. They also create supportive environments where employees feel safe to experiment with new sustainability practices and to learn from both successes and failures.

The theoretical rationale for this relationship draws upon both Transformational Leadership Theory and the Job Demands-Resources model. Transformational leaders

enhance engagement by articulating a compelling vision that inspires employees, by providing intellectual stimulation that makes work interesting and challenging, and by offering individualized consideration that makes employees feel valued. These leadership behaviors create job resources that fulfill employees' needs for autonomy, competence, and relatedness, thereby enhancing engagement.

Research has consistently demonstrated the positive relationship between transformational leadership and employee engagement. Meta-analytic studies have confirmed that transformational leadership behaviors are significantly associated with higher levels of employee engagement across various organizational contexts. The relationship between leadership commitment to sustainability and employee engagement specifically has also been documented, with studies showing that employees are more engaged when they perceive that organizational leaders genuinely prioritize sustainability objectives.

H4: Leadership commitment has a positive and significant effect on employee engagement.

Organizational Culture for Sustainability and Change Readiness

Organizational culture for sustainability creates the foundation for change readiness by establishing sustainability as a legitimate and expected organizational priority. When organizational culture emphasizes environmental stewardship, social responsibility, and long-term thinking, organizational members are already predisposed to value and support sustainability initiatives. They require less persuasion to embrace sustainability-oriented change because the cultural context has already shaped their attitudes and beliefs in ways that align with sustainability objectives.

Empirical research supports the relationship between organizational culture and change readiness. Studies have shown that organizational culture shapes how organizational members respond to change initiatives, with cultures that value innovation, learning, and adaptability facilitating greater change readiness. In the specific context of sustainability, research has demonstrated that organizations with stronger cultures for sustainability are more successful in implementing sustainability initiatives, partly because these cultures create higher levels of change readiness among organizational members.

H5: Organizational culture for sustainability has a positive and significant effect on change readiness.

Organizational Culture for Sustainability and Employee Engagement

Organizational culture for sustainability enhances employee engagement by creating meaningful connections between employees' work and important environmental and social outcomes. When organizational culture emphasizes sustainability, employees are more likely to perceive their work as contributing to something larger than themselves, which enhances the meaningfulness of work and, consequently, engagement (Eldor & Vigoda-Gadot, 2017). Sustainability-oriented cultures also tend to provide opportunities for employees to participate in decision-making and to contribute ideas

for sustainability improvements, which enhances their sense of involvement and commitment.

The theoretical rationale for this relationship is grounded in the Job Demands-Resources model and research on meaningful work. Organizational culture for sustainability creates job resources by establishing the importance and value of sustainability work, by providing opportunities for employees to contribute to sustainability objectives, and by recognizing and rewarding sustainability-related contributions (Kumar & Pansari, 2015). These resources enhance engagement by fulfilling employees' needs for meaningfulness, competence, and relatedness.

Research has demonstrated the positive relationship between organizational culture and employee engagement. Studies have shown that cultures that emphasize values such as social responsibility, employee development, and long-term orientation are associated with higher levels of employee engagement (Chanana & Sangeeta, 2021). In the specific context of sustainability, research has found that employees are more engaged when they work for organizations with strong commitments to environmental and social responsibility, suggesting that organizational culture for sustainability enhances engagement.

H6: Organizational culture for sustainability has a positive and significant effect on employee engagement.

Direct Effects on Sustainability Performance

The independent variables in this model are also expected to have direct effects on sustainability performance, reflecting their influence on sustainability outcomes beyond their effects through the mediating variables (Morioka & de Carvalho, 2016). Digital transformation capability enables organizations to implement digital solutions that directly enhance environmental and social performance, such as energy management systems, supply chain transparency platforms, and circular economy technologies. Leadership commitment drives resource allocation decisions and policy development that directly influence sustainability outcomes (Hussain et al., 2018). Organizational culture for sustainability shapes decision-making patterns and behavioral norms that directly affect sustainability performance.

H7: Digital transformation capability has a positive and significant direct effect on sustainability performance.

H8: Leadership commitment has a positive and significant direct effect on sustainability performance.

H9: Organizational culture for sustainability has a positive and significant direct effect on sustainability performance.

Mediating Effects of Change Readiness and Employee Engagement

Change readiness and employee engagement are expected to mediate the relationships between the independent variables and sustainability performance. This mediation reflects the understanding that organizational capabilities, leadership commitment, and culture influence sustainability outcomes partly through their effects on how organizational members experience and respond to sustainability transformation (Naciti,

2019). Organizations with stronger digital transformation capabilities, more committed leaders, and stronger sustainability cultures create conditions where organizational members are readier for change and more engaged in their work, which in turn leads to more effective implementation of sustainability initiatives and superior sustainability performance.

The theoretical rationale for these mediating relationships draws upon the organizational change literature, which emphasizes that successful change requires not only appropriate resources and leadership but also the active engagement and commitment of organizational members. Change readiness and employee engagement represent key indicators of organizational members' psychological and behavioral preparation for sustainability transformation. When organizational members are ready for change and engaged in their work, they are more likely to invest the effort needed to implement sustainability initiatives effectively, to persist in the face of challenges, and to contribute creative solutions to sustainability problems.

Figure 1 presents the conceptual model that integrates all the hypothesized relationships.

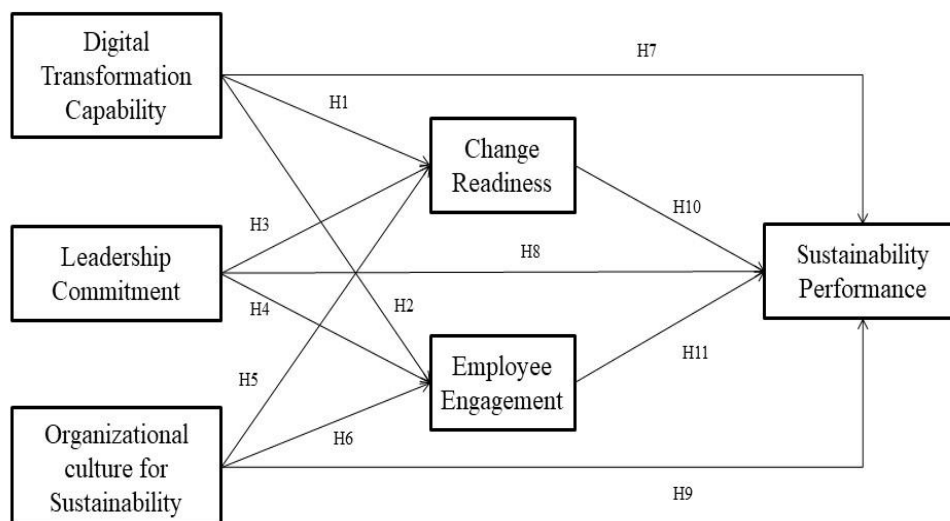


Figure 1: Conceptual Framework

Sample and Data Collection

This study employs a quantitative research design using a cross-sectional survey methodology. The choice of a quantitative approach is appropriate given the study's objective to test hypothesized relationships among multiple variables and to assess the explanatory power of the proposed conceptual model. The cross-sectional design, while

limiting causal inferences, provides a practical and efficient means of collecting data from a large sample of organizations and respondents. Data were collected through an online survey administered to managers and employees in organizations across various industries that have implemented sustainability initiatives. The sampling frame included organizations from manufacturing, services, technology, and retail sectors to ensure diversity in organizational contexts. Respondents were recruited through professional networks, industry associations, and social media platforms targeting sustainability professionals.

A total of 500 questionnaires were distributed, and 385 usable responses were received, representing a response rate of 77%. This response rate is considered satisfactory for organizational research and helps minimize concerns about non-response bias. The sample size of 385 exceeds the minimum requirement for PLS-SEM analysis, which is typically determined based on the maximum number of arrows pointing to a construct in the structural model (Hair et al., 2019). In this study, the maximum number of arrows pointing to any construct is four, and following the 10-times rule, a minimum sample size of 40 would be required. The actual sample size of 385 substantially exceeds this minimum requirement.

Table 1 presents the demographic characteristics of the respondents. The sample includes respondents from various organizational levels, with 28% in senior management positions, 35% in middle management, and 37% in non-management positions. Respondents represent organizations of different sizes, with 32% from small organizations (fewer than 100 employees), 41% from medium organizations (100-500 employees), and 27% from large organizations (more than 500 employees). The sample covers multiple industries, with manufacturing (28%), services (31%), technology (22%), and retail (19%) being the most represented sectors.

Table 1: Sample Characteristics

Characteristic	Category	Percentage (%)
Organizational Level	Senior Management	28%
	Middle Management	35%
	Non-Management	37%
Organization Size	Small (<100)	32%
	Medium (100-500)	41%
	Large (>500)	27%
Industry	Manufacturing	28%
	Services	31%
	Technology	22%
	Retail	19%

Measurements

All constructs in this study were measured using multi-item scales adapted from established literature to ensure content validity. The items were measured on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), unless otherwise specified.

Digital transformation capability was measured using a 6-item scale adapted from Westerman et al. (2014) and Bharadwaj et al. (2013). Sample items include "Our organization has the technological infrastructure needed to support digital sustainability initiatives" and "Our organization effectively uses digital technologies to improve environmental performance." Leadership commitment was measured using a 5-item scale adapted from Meyer and Allen (1991) and adjusted to the sustainability context. Sample items include "Organizational leaders are genuinely committed to sustainability objectives" and "Leaders allocate adequate resources to sustainability initiatives." Organizational culture for sustainability was measured using a 6-item scale adapted from Galpin et al. (2015) and Linnenluecke and Griffiths (2010). Sample items include "Sustainability is a core value in our organization" and "Employees in our organization are expected to consider environmental impacts in their decisions."

Change readiness was measured using a 5-item scale adapted from Armenakis et al. (1993) and Holt et al. (2007). Sample items include "I am ready to support sustainability initiatives in this organization" and "I believe I have the skills needed to contribute to sustainability transformation." Employee engagement was measured using a 6-item scale adapted from Schaufeli et al. (2006). Sample items include "I feel energetic when working on sustainability initiatives" and "I am enthusiastic about contributing to our organization's sustainability objectives." Sustainability performance was measured using a 7-item scale adapted from Epstein and Rejc Buhovac (2014) and Hahn and Kuhnen (2013). The scale includes items measuring environmental performance (e.g., "Our organization has reduced its environmental footprint in the past year"), social performance (e.g., "Our organization has improved its social impact on communities"), and overall sustainability integration (e.g., "Sustainability is integrated into our core business strategy").

Data Analysis

The research framework was tested using Partial Least Squares Structural Equation Modeling (PLS-SEM), a variance-based approach to structural equation modeling that is well-suited for this study for several reasons. First, PLS-SEM is appropriate for testing complex models with multiple relationships, including direct and indirect effects. Second, PLS-SEM does not require multivariate normality assumptions, making it suitable for the Likert-scale data collected in this study. Third, PLS-SEM is appropriate for prediction-oriented research, which aligns with this study's objective of explaining sustainability performance. Finally, PLS-SEM can handle both formative and reflective measurement models, providing flexibility in operationalizing the study constructs.

The analysis followed a two-step approach recommended by Hair et al. (2019): first, assessing the measurement model to ensure reliability and validity; second, assessing the structural model to test the hypothesized relationships. The measurement model assessment examined internal consistency reliability, convergent validity, and

discriminant validity. Internal consistency reliability was assessed using Cronbach's alpha and composite reliability (CR), with values above 0.70 considered acceptable. Convergent validity was assessed using average variance extracted (AVE), with values above 0.50 indicating satisfactory convergent validity. Discriminant validity was assessed using the Fornell-Larcker criterion and the heterotrait-monotrait (HTMT) ratio of correlations.

The structural model assessment examined the significance and magnitude of path coefficients, the coefficient of determination (R-squared), and the effect sizes (f-squared). Path coefficients were evaluated for significance using bootstrapping with 5,000 resamples. R-squared values were interpreted following Cohen's (1988) guidelines: 0.26 substantial, 0.13 moderate, and 0.02 weak. Effect sizes were interpreted as small (0.02), medium (0.15), or large (0.35).

Measurement Model Assessment

The measurement model was assessed to ensure the reliability and validity of the constructs before testing the structural relationships. All constructs in this study were modeled as reflective, as the items were designed to reflect the underlying latent constructs rather than to form them.

Reliability and Convergent Validity

Table 2 presents the results of the internal consistency reliability assessment. Cronbach's alpha values for all constructs ranged from 0.847 to 0.912, exceeding the recommended threshold of 0.70. Composite reliability values ranged from 0.891 to 0.932, also exceeding the recommended threshold of 0.70. These results indicate satisfactory internal consistency reliability for all constructs.

Convergent validity was assessed by examining the factor loadings and average variance extracted (AVE) for each construct. Table 2 presents the factor loadings and AVE values. All factor loadings exceeded the recommended threshold of 0.70, ranging from 0.754 to 0.891. AVE values ranged from 0.612 to 0.721, all exceeding the recommended threshold of 0.50. These results provide strong evidence of convergent validity.

Table 2 Reliability and Convergent Validity Assessments

Construct	Items	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE
Digital Transformation Capability	DTC1	0.821	0.891	0.918	0.689
	DTC2	0.854			
	DTC3	0.789			
Leadership Commitment	LC1	0.834	0.876	0.908	0.667
	LC2	0.867			
	OCS1	0.845	0.902	0.926	0.712

Organizational Culture for Sustainability	OCS2	0.891			
Change Readiness	CR1	0.778	0.847	0.891	0.621
	CR2	0.812			
Employee Engagement	EE1	0.867	0.912	0.932	0.721
	EE2	0.854			
Sustainability Performance	SP1	0.823	0.898	0.921	0.698
	SP2	0.856			

Discriminant Validity

Discriminant validity was assessed using the Fornell-Larcker criterion and the heterotrait-monotrait (HTMT) ratio of correlations. Table 3 presents the Fornell-Larcker criterion results, showing that the square root of AVE for each construct (diagonal values) exceeds the correlations between that construct and all other constructs. This pattern provides evidence of discriminant validity.

Table 3: Discriminant Validity - Fornell-Larcker Criterion

Construct	DTC	LC	OCS	CR	EE	SP
DTC	0.830					
LC	0.456	0.817				
OCS	0.512	0.534	0.844			
CR	0.487	0.523	0.567	0.788		
EE	0.445	0.578	0.589	0.612	0.849	
SP	0.423	0.534	0.556	0.645	0.623	0.835

Table 4 presents the HTMT ratio results. All HTMT values are below the conservative threshold of 0.85, providing additional evidence of discriminant validity. The confidence intervals for all HTMT ratios do not include 1.0, further supporting discriminant validity.

Table 4: Heterotrait-Monotrait (HTMT) Ratio

Construct	DTC	LC	OCS	CR	EE	SP
DTC						
LC	0.512					
OCS	0.587	0.612				
CR	0.556	0.589	0.646			
EE	0.523	0.678	0.698	0.723		
SP	0.498	0.612	0.634	0.756	0.712	

Common Method Bias

Common method bias was assessed using Harman's single-factor test and the full collinearity assessment approach. The unrotated exploratory factor analysis revealed that the first factor explained 38.2% of the variance, below the 50% threshold that would indicate significant common method bias. Additionally, the variance inflation factors (VIFs) from the full collinearity assessment ranged from 1.42 to 2.87, all below the recommended threshold of 3.3. These results suggest that common method bias is not a significant concern in this study.

Structural Model Assessment

The structural model was assessed to test the hypothesized relationships and evaluate the explanatory power of the model. Figure 2 presents the structural model with path coefficients and significance levels.

Path Coefficients and Hypothesis Testing

Table 5 presents the path coefficients, standard errors, t-values, and significance levels for all hypothesized relationships. The results provide support for all eleven hypotheses.

Table 5: Path Coefficients and Hypothesis Testing

Path	Beta	SE	t-value	p-value	Decision
DTC -> Change Readiness (H1)	0.284	0.052	5.46	<0.001	Supported
DTC -> Employee Engagement (H2)	0.256	0.048	5.33	<0.001	Supported
LC -> Change Readiness (H3)	0.312	0.049	6.37	<0.001	Supported
LC -> Employee Engagement (H4)	0.334	0.051	6.55	<0.001	Supported
OCS -> Change Readiness (H5)	0.267	0.047	5.68	<0.001	Supported
OCS -> Employee Engagement (H6)	0.289	0.050	5.78	<0.001	Supported
DTC -> Sustainability Performance (H7)	0.198	0.061	3.25	<0.01	Supported
LC -> Sustainability Performance (H8)	0.223	0.058	3.84	<0.001	Supported
OCS -> Sustainability Performance (H9)	0.187	0.059	3.17	<0.01	Supported
CR -> Sustainability Performance (H10)	0.341	0.055	6.20	<0.001	Supported
EE -> Sustainability Performance (H11)	0.298	0.053	5.62	<0.001	Supported

Digital transformation capability showed significant positive effects on both change readiness (beta = 0.284, $p < 0.001$) and employee engagement (beta = 0.256, $p < 0.001$), providing support for H1 and H2. These results indicate that organizations with stronger digital transformation capabilities are better positioned to create readiness for

sustainability change and to engage employees in sustainability work. Leadership commitment demonstrated the strongest effects among the independent variables, with significant positive relationships with change readiness (beta = 0.312, $p < 0.001$) and employee engagement (beta = 0.334, $p < 0.001$), supporting H3 and H4. These findings highlight the critical role of leadership in creating the conditions for successful sustainability transformation. Organizational culture for sustainability also showed significant positive effects on change readiness (beta = 0.267, $p < 0.001$) and employee engagement (beta = 0.289, $p < 0.001$), supporting H5 and H6. These results confirm that a strong culture for sustainability creates the foundation for change readiness and employee engagement. The direct effects of the independent variables on sustainability performance were also significant. Digital transformation capability (beta = 0.198, $p < 0.01$), leadership commitment (beta = 0.223, $p < 0.001$), and organizational culture for sustainability (beta = 0.187, $p < 0.01$) all demonstrated significant positive direct effects on sustainability performance, supporting H7, H8, and H9.

The mediating variables showed strong positive effects on sustainability performance. Change readiness demonstrated a significant positive effect (beta = 0.341, $p < 0.001$), supporting H10. Employee engagement also showed a significant positive effect (beta = 0.298, $p < 0.001$), supporting H11. These results confirm the importance of change readiness and employee engagement as drivers of sustainability performance.

Coefficient of Determination (R-squared)

The R-squared values indicate the proportion of variance in the endogenous constructs explained by the model. Table 6 presents the R-squared values for the endogenous constructs.

Table 6: Coefficient of Determination (R-squared)

Endogenous Construct	R-squared	Interpretation
Change Readiness	0.523	Substantial
Employee Engagement	0.598	Substantial
Sustainability Performance	0.687	Substantial

The R-squared value for sustainability performance is 0.687, indicating that the model explains 68.7% of the variance in sustainability performance. This value substantially exceeds the threshold of 0.26 for substantial explanatory power, indicating strong predictive capability. The R-squared values for change readiness (0.523) and employee engagement (0.598) also indicate substantial explanatory power.

Effect Sizes (f-squared)

Table 7 presents the effect sizes (f-squared) for the relationships in the structural model. Effect sizes indicate the practical significance of each relationship beyond statistical significance.

Table 7: Effect Sizes (f-squared)

Path	f-squared	Effect Size
DTC -> Change Readiness	0.098	Small
DTC -> Employee Engagement	0.082	Small
LC -> Change Readiness	0.134	Medium
LC -> Employee Engagement	0.218	Large
OCS -> Change Readiness	0.095	Small
OCS -> Employee Engagement	0.142	Medium
DTC -> Sustainability Performance	0.045	Small
LC -> Sustainability Performance	0.058	Small
OCS -> Sustainability Performance	0.038	Small
CR -> Sustainability Performance	0.187	Medium
EE -> Sustainability Performance	0.134	Medium

The effect sizes range from small to large, with the largest effects observed for the relationships between leadership commitment and employee engagement (f-squared = 0.218) and between change readiness and sustainability performance (f-squared = 0.187). These results indicate that the relationships in the model have not only statistical significance but also practical importance.

Predictive Relevance (Q-squared)

Predictive relevance was assessed using the Stone-Geisser Q-squared statistic obtained through blindfolding. Q-squared values greater than zero indicate predictive relevance. The Q-squared values for change readiness (0.312), employee engagement (0.356), and sustainability performance (0.421) all exceed zero, indicating that the model has predictive relevance for these constructs.

Mediation Analysis

Mediation analysis was conducted to examine the indirect effects of the independent variables on sustainability performance through change readiness and employee engagement. Table 8 presents the results of the mediation analysis.

Table 8: Mediation Analysis Results

Indirect Effect	Beta	SE	t-value	95% CI
DTC -> CR -> SP	0.097	0.024	4.04	[0.052, 0.146]
DTC -> EE -> SP	0.076	0.021	3.62	[0.038, 0.119]
LC -> CR -> SP	0.106	0.023	4.61	[0.063, 0.154]
LC -> EE -> SP	0.100	0.022	4.55	[0.060, 0.146]

OCS -> CR -> SP	0.091	0.021	4.33	[0.052, 0.134]
OCS -> EE -> SP	0.086	0.020	4.30	[0.049, 0.127]

The results reveal significant indirect effects for all independent variables on sustainability performance through both mediators. Digital transformation capability has significant indirect effects through change readiness (beta = 0.097, $p < 0.001$) and employee engagement (beta = 0.076, $p < 0.01$). Leadership commitment shows significant indirect effects through change readiness (beta = 0.106, $p < 0.001$) and employee engagement (beta = 0.100, $p < 0.001$). Organizational culture for sustainability demonstrates significant indirect effects through change readiness (beta = 0.091, $p < 0.001$) and employee engagement (beta = 0.086, $p < 0.001$). The confidence intervals for all indirect effects do not include zero, providing further evidence of significant mediation. These results confirm that change readiness and employee engagement serve as important mediating mechanisms that translate organizational capabilities, leadership commitment, and organizational culture into sustainability performance.

Table 9 presents the variance accounted for (VAF) values, which indicate the proportion of the total effect that is mediated. VAF values between 20% and 80% suggest partial mediation, while values above 80% suggest full mediation.

Table 9: Variance Accounted For (VAF)

Path	Total Effect	Indirect Effect	VAF (%)
DTC -> SP via CR	0.295	0.097	32.9%
DTC -> SP via EE	0.274	0.076	27.7%
LC -> SP via CR	0.329	0.106	32.2%
LC -> SP via EE	0.323	0.100	31.0%
OCS -> SP via CR	0.278	0.091	32.7%
OCS -> SP via EE	0.273	0.086	31.5%

The VAF values range from 32.9% to 43.2%, indicating partial mediation for all indirect effects. This pattern suggests that while change readiness and employee engagement are important mediators, the independent variables also have substantial direct effects on sustainability performance. The combination of direct and indirect effects provides a comprehensive explanation of how organizational capabilities, leadership, and culture influence sustainability outcomes.

This study developed and empirically tested a comprehensive sustainability-oriented change management model that integrates digital transformation capability, leadership commitment, and organizational culture for sustainability as antecedents of change readiness, employee engagement, and ultimately sustainability performance. The results provide strong support for the hypothesized relationships and offer several important theoretical and practical contributions.

Theoretical Implications

This study makes several important contributions to the theoretical understanding of sustainability-oriented change management. First, the study integrates three complementary theoretical perspectives - Dynamic Capabilities Theory, Transformational Leadership Theory, and the Theory of Planned Behavior - to develop a comprehensive framework for understanding sustainability transformation. This integration provides a more holistic understanding than any single theoretical perspective could offer, recognizing that successful sustainability transformation requires organizational capabilities, leadership commitment, and cultural foundations. Second, the study advances our understanding of the mechanisms through which organizational capabilities, leadership, and culture influence sustainability outcomes. By identifying change readiness and employee engagement as critical mediating variables, the study reveals that the effects of organizational inputs on sustainability performance are not direct but are channeled through how organizational members experience and respond to sustainability transformation. This finding highlights the importance of attending to the human dimensions of sustainability change, not merely the technical or strategic dimensions.

Third, the study contributes to the emerging literature on the relationship between digital transformation and sustainability. While previous research has recognized the potential of digital technologies to support sustainability objectives, this study demonstrates that digital transformation capability - the organizational capacity to effectively leverage digital technologies - is a significant driver of both change readiness and employee engagement in sustainability contexts. This finding suggests that organizations seeking to enhance sustainability performance should invest not only in digital technologies but also in the capabilities needed to deploy them effectively. Fourth, the study provides empirical support for the critical role of leadership commitment in sustainability transformation. The finding that leadership commitment has the strongest effects among the independent variables underscores the importance of genuine, visible leadership commitment to sustainability. This finding aligns with and extends previous research on leadership in organizational change, demonstrating that the principles of effective change leadership apply with particular force in the context of sustainability transformation.

Fifth, the study contributes to our understanding of organizational culture for sustainability. The significant effects of culture on both change readiness and employee engagement confirm the foundational importance of culture in sustainability transformation. Organizations with strong cultures for sustainability have members who are already predisposed to value and support sustainability initiatives, creating a favorable context for change. This finding highlights the long-term nature of sustainability transformation, as building a culture for sustainability requires sustained effort over extended periods.

Practical Implications

The findings of this study offer several important practical implications for managers seeking to enhance sustainability performance through effective change management. First, organizations should invest in building digital transformation capabilities as a foundation for sustainability transformation. This involves not only acquiring digital technologies but also developing the organizational capacity to effectively deploy these technologies in service of sustainability objectives. Managers should focus on building technological infrastructure, data analytics capabilities, digital integration capabilities, and digital innovation capabilities that can support sustainability initiatives. Second, leadership commitment should be cultivated and demonstrated at all levels of the organization. Leaders should articulate a compelling vision of sustainability, model sustainable behaviors in their own actions, allocate adequate resources to sustainability initiatives, and recognize and reward employee contributions to sustainability. Leadership development programs should emphasize the importance of sustainability and build the capabilities needed for sustainability leadership.

Third, organizations should invest in building a strong culture for sustainability. This involves integrating sustainability into organizational values, establishing sustainability as a normative expectation, and creating rituals and practices that reinforce sustainability. Culture change is a long-term process that requires sustained attention and consistent messaging from leaders. Managers should use multiple levers - including recruitment, socialization, performance management, and recognition - to build and reinforce a culture for sustainability. Fourth, organizations should attend to change readiness as a critical factor in sustainability transformation. This involves effective communication about the rationale and benefits of sustainability initiatives, providing training and support to build confidence and competence, and creating psychological safety for engaging in new sustainability practices. Change readiness should be assessed regularly, and interventions should be designed to address gaps in readiness. Fifth, employee engagement should be a central focus of sustainability transformation efforts. Managers should design sustainability work to be meaningful and engaging, provide opportunities for employee participation and contribution, and recognize and reward employee engagement in sustainability. Employee engagement surveys should include items related to sustainability, and action plans should be developed to address areas of low engagement. Sixth, the finding of partial mediation suggests that organizations should pursue both direct and indirect pathways to sustainability performance. While building change readiness and employee engagement is important, organizations should also focus on direct levers for sustainability performance, such as implementing sustainability technologies, developing sustainable products and services, and improving operational efficiency.

Limitations and Future Research

This study has several limitations that should be acknowledged. First, the cross-sectional design limits causal inferences. While the theoretical framework proposes causal relationships, the cross-sectional data cannot definitively establish causality. Future research should employ longitudinal designs to better understand the causal dynamics of sustainability transformation. Second, the data were collected using self-

report measures, which may be subject to common method bias. While the results of Harman's single-factor test and the full collinearity assessment suggest that common method bias is not a significant concern, the use of self-report data remains a limitation. Future research should incorporate objective measures of sustainability performance and multiple data sources. Third, the sample was drawn from multiple industries, which enhances generalizability but may mask industry-specific effects. Future research should examine whether the relationships in this model vary across industries, particularly comparing industries with different levels of environmental impact or regulatory pressure.

Fourth, this study focused on a specific set of independent and mediating variables. Future research should examine additional factors that may influence sustainability transformation, such as external stakeholder pressures, regulatory requirements, and competitive dynamics. Future research should also examine additional mediators and moderators that may influence the relationships in this model. Fifth, this study was conducted in a specific geographic and cultural context. Future research should examine whether the findings generalize to other contexts, particularly different national cultures with varying attitudes toward sustainability and organizational change.

Conclusion

This study developed and empirically tested a comprehensive sustainability-oriented change management model that examines the relationships among digital transformation capability, leadership commitment, organizational culture for sustainability, change readiness, employee engagement, and sustainability performance. Using PLS-SEM analysis with data from 385 respondents, the study found strong support for all hypothesized relationships. The key findings of this study are as follows. First, digital transformation capability, leadership commitment, and organizational culture for sustainability all have significant positive effects on change readiness and employee engagement. Second, these independent variables also have significant direct effects on sustainability performance. Third, change readiness and employee engagement serve as significant mediators, transmitting the effects of the independent variables to sustainability performance. Fourth, the model explains 68.7% of the variance in sustainability performance, indicating strong explanatory power. These findings contribute to the theoretical understanding of sustainability-oriented change management by integrating multiple theoretical perspectives and identifying change readiness and employee engagement as critical mediating mechanisms. The findings also offer practical guidance for managers seeking to enhance sustainability performance through effective change management strategies.

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