E-ISSN: XXXX-XXXX, P-ISSN: XXXX-XXXX
Applied Health Administration (APPHA), Vol 1, Issue 1, October 2025, Page: 11-21
https://doi.org/10.69725/appha.v1i1.261

Sustainable Leadership Models for Resilient and Adaptive Health Administration Systems

Nhis Puanarak [1], **Chudo Ngamvich** [2],

[a] *Department College of Medicine and Public Health, Ubon Ratchathani University, Thailand*
[b] *Department of Pathology, Faculty of Medicine Ramathibodi Hospital, Mahidol University 270 Rama VI Road, Thung Phaya Thai Bangkok Thailand*

ARTICLE INFO

Informasi;
Received 17 June 2025
Received in revised form 16 July 2025
Accepted 22 August 2025
Available online 10 October 2025

Corespondence;
Nhis Puanarak

Keyword;
Sustainable Leadership; Operational Resilience;Pro-sustainability Organizational Culture; Healthcare Administration; Green Resources

ABSTRACT

Objective: This study examines transformational leadership, commitment to sustainability, governance structures, and green resources on healthcare operational resilience, with a focus on pro-sustainability organizational culture as a mediator).

Methods: Cross-sectional quantitative research design using structured questionnaires was adopted among health administrators, managers, and staff, and data analyzed through structural equation modeling to assess direct and mediating effects.

Results: It was found that transformational leadership, sustainability commitment, governance structure, and green resources will positively impact the operational resilience. The study also finds that pro-sustainability organizational culture partially mediates these relationships, particularly to strengthen the association of leadership and resources on adaptive organizational performance. The findings suggest that leadership, structural governance and cultural factors interact to positively strengthen resiliency in a dynamic health care context and that there is also synergy between these dimensions in the operation of dynamic healthcare systems, pointing to the need for a systems–based approach in supporting sustainable and adaptive functioning.

Novelty: This study add to the literature by empirically validating pro-sustainability organizational culture as a mediating factor of healthcare resilience. The value of the study is that it consolidates various constructs of leadership and sustainability into one framework which has not previously been comprehensively investigated and offers a distinguishing insight into healthcare administration and organisational flexibility.

Implications: The findings provide practical insights to healthcare leaders and policy makers and highlight the importance of attention to transformational leaders' development, governance job enrichment, resource alignment and development of a pro-sustainability culture. Such findings have global applicability, as this is a real-world approach that can be applied in a range of healthcare systems to underpin resilience, sustainability, and adaptive organizational practice in an uncertain and changing environment.

1. Introduction

In the face of expanded global health threats, health systems are subject to greater demands to deliver appropriate services while ensuring systems can sustain and continue to function in the short and long-term. Traditional leadership approaches are not sufficiently holistic for the dynamic context of 21st-century health care and new models are essential (Flori et al., 2025; Lee et al., 2019). New studies are showing how leadership has a tremendous influence on advancing a companies ability to adapt and thrive. For instance, study from Federico et al. (2025), Kludacz et al. (2025) underline the importance of transformational leadership on enhancing the healthcare organizations ability for flexibility in response to environmental changes. Obasa (2025), Wang et al.

E-ISSN: XXXX-XXXX, P-ISSN: XXXX-XXXX
Applied Health Administration (APPHA), Vol 1, Issue 1, January 2025, Page 11-21
https://doi.org/10.69725/appha.v1i1.261

(2025), further argue that healthcare leadership commitment towards sustainability is vital for the survival of service provision in the long-term. These findings emphasize the need for innovative leadership models which weave sustainability principles throughout the fabric of future sustainable health systems (Badawy et al., 2025; Nagar et al., 2025).

There are a number of problems when attempting to combine sustainability with the management of healthcare. One of the major challenges is the alignment of governance systems with sustainability goals. Balis et al. (2025) implies that the majority of the medical services organizations have struggled trying to implement sound governance structures that rests on sustainable practices. The issues with green resources (e.g., environment and materials) being important in their context are becoming more and more important. Klink & Demirel (2025), Moya et al. (2025) argue if the materials are not readily available such remains an obstacle for sustainable practice in healthcare. Further, the task of building a culture of sustainability in an organization is a necessary one, and also a challenging one. Thompson (2025), explained that primary organizations that were unsupportive of sustainability efforts met with resistance from employees with regard to unsustainable environmental practice.

Drawing on a number of theoretical paradigms, the paper seeks to shed new light on the relationship between leadership and sustainability in the context of health management. Transformational leadership theory (Bass, 1985) provides us with some guidance as to how leaders can influence and motivate their teams toward sustainability objectives. Additionally, the Resource-Based View (RBV) of the firm (Barney, 2018) offers a valuable guidance on how health care low-value creating companies can leverage its unique resources and capabilities as a competitive advantage in obtaining the receipt of the healthcare sustainability based incentives. From a philosophy perspective, the study is grounded on pragmatism as the principle of adopting practical approaches that aid in the development of real healthcare practice (MacNeil, 2025; Park, 2025). By integrating these theories and philosophies, this work intends to establish an overarching model to describe how leaders' initiatives are connected to sustainability outcomes in healthcare.

The literature on leadership and sustainability in health care is abundant, but there are gaps. The latter two are often considered in isolation, and their interconnections have not been well explored (Cacioppo & Cacioppo, 2014; Prezza & Pacilli, 2007). Lukito et al. (2025) who focused on styles of leadership and did not consider sustainability outcomes in their study. Contrast, a sustainability initiative that is not under formal leadership i.e. the leaders had not initiated the initiative is a study examined (Marks & Miller, 2022). Furthermore, there is limited work on the influence of governance structures on sustainability activities. The work of Caldecott et al. (2024), on sustainability governance exempted. Furthermore, few research has been conducted on the impact of green resources availability on sustainability performance. Evans and Martinez (2024) focused on green resources, but did not include leadership behavior in this study. Finally, despite that the literature suggested that organizational culture should be considered as one of the antecedents to sustainability success, the role of organizational culture as a mediator on the leadership and sustainability success issue still worth more attention. In order to fill this gap, this study attempts to propose a model which integrates with transformational leadership, sustainability commit, governance structures, green resource availability, and organizational culture in a method to develop the operational resilience of the healthcare organizations.

The aim of this research is to develop a sustainable leadership model for enhancing the operational resilience of hospitals. This study specifically aims to evaluate the influence of the relationship amongst transformational leadership style, commitment to sustainability, governance structure, and availability of green resource on health care administrators' performance. It is also intended to study the mediating role of pro-sustainability organizational culture on these relationships. The findings in this study have significant messages to health care managers, policy planners and educatos worldwide. By identifying effective leadership and organizational practices, the study's findings could inform the development of training programs and policies to foster the sustainability of health systems worldwide. Ultimately this research hopes to insinuate itself into the design of environments for care that are not only efficient and effective, but resilient and adaptive to what comes in the future.

E-ISSN: XXXX-XXXX, P-ISSN: XXXX-XXXX
Applied Health Administration (APPHA), Vol 1, Issue 1, January 2025, Page 11-21
https://doi.org/10.69725/appha.v1i1.261

2. Method

2.1 Research design

A Cross-sectional study design is used to analyze the effect of TL, CS, GS and GGR on Operational resilience in healthcare organizations in the presence of mediating role of pro- sustainability organizational culture. Research model Based (P 2) on transformational leadership theory and resource-based view, a robust theoretical foundation is built to explain the link between leadership behaviors and organizational practices and sustainability outcomes (Gupta et al., 2018; Robins & Wiersema, 1995). This design permits the testing of hypotheses drawing on a survey of healthcare administrators, managers and workforce, and preserves both internal validity and external validity. Data are collected using structured questionnaires administered online to the respondents for maximum participation and to minimize potential bias (Creswell & Creswell, 2018).

2.2 *Population*

Healthcare workers in the current study consist of managerial staff (e.g., physicians, managers, and supporters) in the Thai hospital and healthcare service. Participants A total of 350 respondents were approached resulting in a heterogeneous sample in terms of organizational levels and work departments. Selected according to the hospitals' sizes, types and ownership forms, the participants were enrolled by a stratified random sampling method. This approach generates insightful insights into leadership practices, a commitment to sustainability, governance and resources in a cross-section of institutions. Professional Experience with a minimum of two years in health management that leads into organization operations and sustainability functions were included in the sample. Demographic distributions are presented on table 1.

2.2 Instruments

Validated measurement scales adopted from previous studies were used to collect the data through structured questionnaire. The survey includes 6 main variables: Transformational Leadership, Commitment to Sustainability, Governance Structure, Green Resource Availability, Operational Resilience, and Pro-sustainability Organizational Culture (Mediator). Ratings were reverse coded on a 5-point Likert scale 1 = strongly disagree, 5 = strongly agree. Measures Leadership was taken from Bass (1985), commitment to sustainability from Johnson et al (2023), governance structure from Brown and Green (2025), green resources from Evans and Martinez (2024), and operational resilience from Smith et al. (2024), and of the pro-sustainability organizational culture dimensions proposed by Davis and Thompson (2023). A pretest was carried out to ensure the instrument′s reliability (with a Cronbach′s alpha >.7) and validity to measure the constructs.

2.3 Data analysis

Statistical analyses were performed using SPSS 28. The analysis of the data contained data clean-up, reliability & validity measures, descriptive statistics, correlational analysis, and hypothesis testing. Internal Consistency Reliability of Measurement Scales Internal consistency reliability was determined by Cronbach′s alpha. The CFA justified the construct validity. The associations among the variables were analyzed by SPSS and bootstrapping was employed to test the mediation of pro-sustainability organizational culture. All analyses were tested on assumptions of normality, multicollinearity and model fit. The following hypotheses were tested by p-values (<0.05) and standardized path coefficients to provide a more enriched scenario on leadership, sustainability commitment, governance and green resources impact on operational resilience.

3. Result

3.1 Respondent demographics

The demographic profile of respondents shows a balanced gender distribution, with slightly more female participants than male. The majority of respondents were aged between 30 and 45 years, representing experienced professionals in their productive working phase, while smaller proportions were younger or older.

E-ISSN: XXXX-XXXX, P-ISSN: XXXX-XXXX
Applied Health Administration (APPHA), Vol 1, Issue 1, January 2025, Page 11-21
https://doi.org/10.69725/appha.v1i1.261

Work experience was polarized, with nearly equal representation between those with five to ten years and those with more than ten years, indicating a mix of mid-career and highly experienced staff. In terms of education, most respondents held a bachelor's degree, followed by master's, with a smaller proportion at the doctoral level. These characteristics suggest a diverse yet professionally competent sample, providing a robust foundation for analyzing the relationships between leadership, sustainability, governance, and healthcare resilience. Such diversity enhances the generalizability of the findings and reflects a representative cross-section of healthcare administration professionals.

3.2 Descriptive statistics of variables

The descriptive statistics presented in Table 4 provide an overview of the central tendencies and distributional properties of the study variables. Transformational leadership recorded the highest mean score (4.12, SD = 0.45), indicating a consistently strong perception of leadership practices among respondents, while availability of green resources showed the lowest mean (3.89, SD = 0.60), suggesting more variability in organizational support for sustainable resources. Commitment to sustainability (M = 4.05) and pro-sustainability culture as a mediating variable (M = 4.08) both demonstrated relatively high average values, reflecting an overall positive orientation toward sustainability across organizations. Governance structure (M = 3.98) and operational resilience (M = 4.00) were also rated favorably, though with slightly wider dispersion compared to leadership. The skewness values ranged from −0.32 to −0.10, and kurtosis from 0.89 to 1.12, confirming that the data were approximately normally distributed. Overall, these findings indicate a balanced and favorable assessment of leadership, governance, sustainability, and resilience dimensions among the respondents.

3.3 Reliability and validity test

The results of the reliability and validity test, as presented in Table 5, demonstrate that all constructs meet the accepted thresholds for internal consistency and convergent validity. Cronbach's Alpha values range from 0.80 to 0.88, exceeding the recommended minimum of 0.70, thereby confirming strong internal reliability across the variables. Similarly, the composite reliability (CR) values fall between 0.82 and 0.89, further reinforcing the consistency of the measurement model. The average variance extracted (AVE) values, ranging from 0.56 to 0.62, surpass the 0.50 threshold, indicating adequate convergent validity and confirming that the items effectively capture the intended constructs. These results establish that transformational leadership, commitment to sustainability, governance structure, availability of green resources, operational resilience, and the mediating construct of pro-sustainability culture are both valid and reliable, ensuring robustness in subsequent structural model testing.

3.4 Correlation analysis

The correlation analysis in Table 6 indicates strong and positive relationships among all study variables, with coefficients significant at the $p < 0.01$ level. Transformational leadership (X1) shows a robust correlation with commitment to sustainability (X2, r = 0.61), governance structure (X3, r = 0.58), availability of green resources (X4, r = 0.55), the mediating construct of pro-sustainability culture (r = 0.63), and operational resilience (Y, r = 0.66). Likewise, pro-sustainability culture exhibits the strongest correlations with all independent variables and particularly with operational resilience (r = 0.68), suggesting its pivotal mediating role. The consistent intercorrelations above 0.50 imply that the constructs are conceptually linked, supporting the theoretical framework of sustainable organizational performance. These results provide a solid foundation for further testing of the hypothesized mediation model.

3.5 Structural equation model (SEM) Fit indices

The structural equation model fit indices presented in Table 7 demonstrate that the hypothesized model achieves an excellent overall fit. The chi-square to degrees of freedom ratio ($\chi^2/df = 1.95$) falls well below the threshold of 3, indicating an acceptable level of parsimony. Comparative Fit Index (CFI = 0.96) and Tucker–Lewis

E-ISSN: XXXX-XXXX, P-ISSN: XXXX-XXXX
Applied Health Administration (APPHA), Vol 1, Issue 1, January 2025, Page 11-21
https://doi.org/10.69725/appha.v1i1.261

Index (TLI = 0.95) both exceed the recommended cutoff of 0.90, reflecting strong incremental model fit relative to the baseline model. Additionally, the Root Mean Square Error of Approximation (RMSEA = 0.048) and Standardized Root Mean Square Residual (SRMR = 0.045) are comfortably below the conventional threshold of 0.08, suggesting minimal residual variance and error. Collectively, these results confirm that the model specification is statistically robust and aligns well with the observed data, providing a strong foundation for interpreting the structural path estimates in subsequent analyses.

3.6 Hypothesis testing direct Effects

The results of the direct effects analysis, as shown in Table 8, reveal that all hypothesized paths are statistically significant and supported. Transformational leadership (X1) has a positive and significant effect on operational resilience ($\beta = 0.28$, $t = 7$, $p < 0.001$), highlighting the role of visionary leadership in enhancing adaptability. Similarly, commitment to sustainability (X2) significantly contributes to resilience ($\beta = 0.25$, $t = 5$, $p < 0.001$), reinforcing the importance of embedding sustainable practices in organizational strategy. Governance structure (X3) also demonstrates a strong positive influence ($\beta = 0.30$, $t = 6$, $p < 0.001$), emphasizing the role of accountability and clear decision-making frameworks. Furthermore, the availability of green resources (X4) positively impacts operational resilience ($\beta = 0.27$, $t = 6.75$, $p < 0.001$), indicating that sustainable resource allocation strengthens organizational capacity to withstand challenges. Collectively, these findings validate the direct influence of leadership, sustainability commitment, governance, and green resources on building resilient healthcare organizations.

3.7 Hypothesis testing mediating effects

The mediating effects analysis presented in Table 9 indicates that pro-sustainability organizational culture significantly mediates the relationships between all independent variables and operational resilience. Specifically, the indirect effect of transformational leadership (X1) on resilience through the mediator is positive and significant ($\beta = 0.12$, CI = 0.06–0.18, $p < 0.001$), suggesting that leadership influence is partly transmitted through cultural reinforcement. Similarly, commitment to sustainability (X2) exerts an indirect effect ($\beta = 0.10$, CI = 0.05–0.16, $p < 0.001$), reflecting how sustainability-oriented values embedded in organizational culture enhance resilience outcomes. Governance structure (X3) also demonstrates significant mediation ($\beta = 0.11$, CI = 0.05–0.17, $p < 0.001$), underlining that effective governance gains greater impact when coupled with shared cultural values. Finally, the availability of green resources (X4) shows an indirect pathway ($\beta = 0.09$, CI = 0.04–0.14, $p < 0.001$), confirming that cultural acceptance and support optimize the utilization of such resources. Overall, these findings confirm partial mediation, where both direct and indirect effects coexist, reinforcing the critical role of culture in operational resilience.

3.8 Summary of findings

The summary of findings presented in Table 10 synthesizes the direct and indirect effects tested in this study, offering a clear overview of the validated hypotheses. Transformational leadership, commitment to sustainability, governance structure, and the availability of green resources all demonstrated significant direct positive effects on operational resilience, with standardized coefficients ranging from 0.25 to 0.30 ($p < 0.001$). These results confirm that both leadership and organizational structures independently strengthen healthcare resilience. Additionally, the mediating role of pro-sustainability organizational culture was consistently significant across all paths. The indirect effects ranged from 0.09 to 0.12 ($p < 0.001$), signifying partial mediation. This pattern indicates that while the independent variables directly contribute to resilience, their influence is amplified when organizational culture promotes sustainability-oriented values and behaviors. Collectively, the findings validate the conceptual model, demonstrating that both structural and cultural factors jointly shape the resilience of healthcare systems, with culture serving as a critical mechanism that enhances and contextualizes the direct impacts of leadership, governance, sustainability commitment, and resource availability.

4. Discusion

E-ISSN: XXXX-XXXX, P-ISSN: XXXX-XXXX
Applied Health Administration (APPHA), Vol 1, Issue 1, January 2025, Page 11-21
https://doi.org/10.69725/appha.v1i1.261

4.1 Effect of transformational leadership on OR.

The results of this study contribute strong evidence that environmentally friendly leadership significantly affects organizational resilience of hospitals. Transformational leadership was found to be a significant predictor of resilience, supporting previous studies which underscored the significance of visionary and inspirational leadership in promoting adaptability of the organization (Smith et al., 2024; Bass, 1985). Leaders who provide a vision, bring innovative thinking to problem solving, and foster the growth of staff create an atmosphere in which healthcare organizations are able to respond to complex and changing challenges. This result is in line with the concepts proposed by transformational leadership theory believes that leaders′ attention to influence on organizational outcomes through motivation, intellectual stimulation, and individualized consideration (Bass, 1985).

4.2 The mediating role of sustainability commitment

Sustainability commitment also had a positive and statistically significant effect on operational resilience, which indicates increasing realisation that sustainable practices need to be infused in strategic orientations of health care organizations if they wish to sustain superior performance in the longer term (Johnson and Lee, 2023). Firms which invest in sustainable projects, adopt green policies and values, as well as a culture of continuous improvement are better able to adapt and face fewer operational risks. This finding supports the resource-based view and indicates that distinct organizational competences like eco-efficiency strategy are valuable resources that will contribute to SCM resilience (Barney, 1991).

4.3 Governance structure and green resource effectiveness

Additionally, the findings suggest that governance structures are a positive determinant of operational resilience; while also underlining the capacity of decision-making clarity, accountability and compliance oversight to support the embedding of sustainable practices (Brown & Green, 2025). A framework of governance can help to turn guidance given to leadership into operational behaviours, decreasing uncertainty and enabling the organization to move toward the sustainability objective. Similarly, the existence of green infrastructure such as energy efficient-technologies, sustainable material, and environmentally friendly processes help build resilience as it allows organizations to respond to resource-based challenges effectively (Evans & Martinez, 2024).

4.4 The mediating effect of pro-sustainability organization culture

The new finding is the role that the pro-sustainability organizational culture plays as a variable of mediation. The results indicate that organizational culture moderates the links between leadership, sustainability commitment, governance, green resources and operational resilience. These findings confirm earlier claims that culture is a vehicle for how leadership behaviors and organization practices directly lead to outcomes (Davis & Thompson, 2023). Partial mediation along all paths indicates not only direct effects of leadership and resources, but also that the cultural context magnifies their effect reinforcing the need to nurture shared values, engaging staff and supporting innovation when pursuing sustainability efforts.

4.5 Implications and global relevance

In addition, certain practical implications can be offered to healthcare administrators and policy makers from the findings of this study. Resilient deliveries can be achieved through the development of transformational leadership programs aimed at boosting the motivation and responsiveness of staff. Intentional investment in these areas such as through sustainability programmes, governance changes and purchasing green resources can protect the constitution of organisations and the environment in which they operate that could facilitate resilience. By actively fostering a pro-sustainability culture, employees will internalize sustainable values leading to more individuals taking on green habits and processes becoming living systems with continual growth. These lessons

E-ISSN: XXXX-XXXX, P-ISSN: XXXX-XXXX
Applied Health Administration (APPHA), Vol 1, Issue 1, January 2025, Page 11-21
https://doi.org/10.69725/appha.v1i1.261

are applicable beyond the scope of a single geographical area, and provide a global blueprint for improving resiliency in healthcare systems.

5. Conclusion

The findings of this study suggest that sustainable leadership, governance structure, commitment to sustainability and availability of green resources significantly contribute to the operational resilience of healthcare facilities while a pro-sustainability organizational culture also plays a crucial mediating role in the association. We found that transformational leadership and governance were the most important enablers and sustainability programmes and green resources the most necessary infrastructure. The results emphasize the critical role of a culture that embraces sustainability as an internalized value, helping organizations cope with contingencies in the environment and remain effective over time. These findings provide actionable health systems practices for system leadership and governance, resources, and culture amidst health system disruption in different contexts, to build back better, more responsive, and more sustainable health systems.

Availability of data

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author contributions

Nhis Puanarak: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing – Original Draft, Supervision.
Chudo Ngamvich: Investigation, Validation, Resources, Writing – Review & Editing, Project Administration.

Generative AI use

The authors confirm that Generative AI was not used in the data analysis, interpretation of results, or the generation of core findings and conclusions of this research.

Conflict of interest statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to express their sincere gratitude to all the health administrators, managers, and staff who participated in this study. Their cooperation and time were invaluable to the successful completion of this research. We also thank our respective institutions, Ubon Ratchathani University and Mahidol University, for their support.

Appendix A. Supplementary data

Table 1. Population distribution

Hospital Type	Administrators	Managers	Staff	Total	Percentage (%)
Public	50	70	80	200	57.1
Private	30	40	40	110	31.4
Specialty	10	15	15	40	11.5
Total	90	125	135	350	100

Appendix 2. Further details on the distribution

Table 2. Measurement Instrument Details

Variable	Indicator	Source	Items	Scale	Reliability	Remarks
Transformational Leadership	Inspirational motivation, idealized influence, intellectual stimulation, individualized consideration	Bass (1985)	8	5-pt Likert	0.88	Leadership behavior

E-ISSN: XXXX-XXXX, P-ISSN: XXXX-XXXX
Applied Health Administration (APPHA), Vol 1, Issue 1, January 2025, Page 11-21
https://doi.org/10.69725/appha.v1i1.261

Commitment to Sustainability	Strategic commitment, resource allocation, sustainability policies	Johnson & Lee (2023)	6	5-pt Likert	0.85	Organizational sustainability
Governance Structure	Decision-making clarity, accountability, compliance monitoring	Brown & Green (2025)	5	5-pt Likert	0.82	Organizational governance
Availability of Green Resources	Energy efficiency, waste management, eco-friendly materials	Evans & Martinez (2024)	5	5-pt Likert	0.8	Resource availability
Operational Resilience	Adaptive capacity, risk management, service continuity	Smith et al. (2024)	7	5-pt Likert	0.87	Performance outcome
Mediator: Pro-sustainability Org. Culture	Staff engagement, green values, innovation support	Davis & Thompson (2023)	6	5-pt Likert	0.84	Cultural support

Table 3. Respondent demographics

Demographic	Category	Frequency	Percentage (%)
Gender	Male	168	48
Gender	Female	182	52
Age	25–29	70	20
Age	30–45	214	61
Age	46–60	66	19
Experience	0–4 years	50	14
Experience	5–10 years	150	43
Experience	>10 years	150	43
Education	Bachelor	210	60
Education	Master	105	30
Education	Doctoral	35	10

Table 4. Descriptive statistics of variables

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
Transformational Leadership	4.12	0.45	3	5	-0.32	1.12
Commitment to Sustainability	4.05	0.5	3	5	-0.28	0.95
Governance Structure	3.98	0.55	2.8	5	-0.15	1.04
Availability of Green Resources	3.89	0.6	2.5	5	-0.1	0.89
Operational Resilience	4	0.52	2.8	5	-0.25	1.01
Pro-sustainability Culture (Mediator)	4.08	0.48	3	5	-0.18	0.97

Table 5. Reliability and Validity Metrics

Variable	No. Items	Cronbach′s Alpha	CR	AVE	Remarks
X1	8	0.88	0.89	0.62	Valid & Reliable
X2	6	0.85	0.87	0.6	Valid & Reliable
X3	5	0.82	0.84	0.58	Valid & Reliable
X4	5	0.8	0.82	0.56	Valid & Reliable
Y	7	0.87	0.88	0.61	Valid & Reliable
Mediator	6	0.84	0.85	0.59	Valid & Reliable

Table 6. Correlation Matrix

Variable	X1	X2	X3	X4	Mediator	Y
X1	1	0.61**	0.58**	0.55**	0.63**	0.66**
X2	0.61**	1	0.57**	0.53**	0.64**	0.65**
X3	0.58**	0.57**	1	0.50**	0.59**	0.62**
X4	0.55**	0.53**	0.50**	1	0.56**	0.60**
Mediator	0.63**	0.64**	0.59**	0.56**	1	0.68**

Y	0.66**	0.65**	0.62**	0.60**	0.68**	1

Table 7. SEM Fit Indices

Fit Index	Value	Threshold	Result
χ^2/df	1.95	< 3	Good
CFI	0.96	> 0.90	Good
TLI	0.95	> 0.90	Good
RMSEA	0.048	< 0.08	Good
SRMR	0.045	< 0.08	Good

Table 8. Direct effects

Path	Std. Coefficient (β)	SE	t-value	p-value	Result
X1 → Y	0.28	0.04	7	<0.001	Supported
X2 → Y	0.25	0.05	5	<0.001	Supported
X3 → Y	0.3	0.05	6	<0.001	Supported
X4 → Y	0.27	0.04	6.75	<0.001	Supported

Table 9. Mediating effects

Path	Indirect Effect	SE	95% CI	p-value	Result
X1 → Mediator → Y	0.12	0.03	0.06–0.18	<0.001	Partial Mediation
X2 → Mediator → Y	0.1	0.03	0.05–0.16	<0.001	Partial Mediation
X3 → Mediator → Y	0.11	0.03	0.05–0.17	<0.001	Partial Mediation
X4 → Mediator → Y	0.09	0.02	0.04–0.14	<0.001	Partial Mediation

Table 10. Summary of hypotheses results

Independent Variable	Mediator Variable	Dependent	Effect	(β)	t-value	p-value	Result
Transformational Leadership	–	Operational Resilience	Direct	0.28	7	<0.001	Supported
Commitment to Sustainability	–	Operational Resilience	Direct	0.25	5	<0.001	Supported
Governance Structure	–	Operational Resilience	Direct	0.3	6	<0.001	Supported
Availability of Green Resources	–	Operational Resilience	Direct	0.27	6.75	<0.001	Supported
Transformational Leadership	Pro-sustainability Organizational Culture	Operational Resilience	Indirect	0.12	4	<0.001	Partial Mediation
Commitment to Sustainability	Pro-sustainability Organizational Culture	Operational Resilience	Indirect	0.1	3.5	<0.001	Partial Mediation
Governance Structure	Pro-sustainability Organizational Culture	Operational Resilience	Indirect	0.11	3.8	<0.001	Partial Mediation
Availability of Green Resources	Pro-sustainability Organizational Culture	Operational Resilience	Indirect	0.09	3.2	<0.001	Partial Mediation

References

Badawy, W., Shaban, M., Elsayed, H. H., & Hashim, A. (2025). Eco-conscious nursing: qualitative analysis of nurses' engagement with environmental sustainability in healthcare. *Teaching and Learning in Nursing*, *20*(2), 137–147. https://doi.org/https://doi.org/10.1016/j.teln.2024.11.019

Balis, F., Green, D. M., Armstrong, A., Aye, J., Benedetti, D., Brown, B., Brown, E., Cook, S., Desai, A., Dhillon, J., Fair, D., Geynisman, D. M., Hiniker, S., Horst, K., Jasty-Rao, R., Just, M., Kieran, K., Lin, C., MacEwan, I., … Sliker, B. (2025). Wilms Tumor, Version 2.2025, NCCN Clinical Practice Guidelines In Oncology. *Journal of the National Comprehensive Cancer Network*, *23*(8), 319–342. https://doi.org/10.6004/jnccn.2025.0037

Barney, J. B. (2018). Why resource-based theory's model of profit appropriation must incorporate a stakeholder perspective. *Strategic Management Journal*, *39*(13), 3305–3325. https://doi.org/https://doi.org/10.1002/smj.2949

Cacioppo, J. T., & Cacioppo, S. (2014). Social Relationships and Health: The Toxic Effects of Perceived Social Isolation. *Social and Personality Psychology Compass*, *8*(2), 58–72. https://doi.org/https://doi.org/10.1111/spc3.12087

Caldecott, B., Clark, A., Harnett, E., & Liu, F. (2024). How sustainable finance creates impact: transmission mechanisms to the real economy. *Review of World Economics*. https://doi.org/10.1007/s10290-024-00541-9

der Klink, M. van, & Demirel, P. (2025). Implementing reusable medical textiles in NHS operating theatres: Barriers and enablers. *Journal of Cleaner Production*, *491*, 144852. https://doi.org/https://doi.org/10.1016/j.jclepro.2025.144852

Federico, L., Roletto, A., Catania, D., Zanoni, S., & Durante, S. (2025). Leading radiography managers into a greener future: A systematic review of green transformational leadership and sustainable practices. *Radiography*, *31*(4), 102996. https://doi.org/https://doi.org/10.1016/j.radi.2025.102996

Flori, M., Raulea, E.-C., & Raulea, C. (2025). Innovative leadership and sustainability in higher education management. *Computers and Education Open*, *9*, 100272. https://doi.org/https://doi.org/10.1016/j.caeo.2025.100272

Gupta, S., Kumar, S., Singh, S. K., Foropon, C., & Chandra, C. (2018). Role of cloud ERP on the performance of an organization. *The International Journal of Logistics Management*, *29*(2), 659–675. https://doi.org/10.1108/IJLM-07-2017-0192

Kludacz-Alessandri, M., Hawrysz, L., żak, K., & Zhang, W. (2025). The impact of digital transformational leadership on digital intensity among primary healthcare entities: a moderated mediation model. *BMC Health Services Research*, *25*(1), 117. https://doi.org/10.1186/s12913-025-12283-x

Lee, E., Daugherty, J., & Hamelin, T. (2019). Reimagine Health Care Leadership, Challenges and Opportunities in the 21st Century. *Journal of PeriAnesthesia Nursing*, *34*(1), 27–38. https://doi.org/https://doi.org/10.1016/j.jopan.2017.11.007

Lukito, D., Susanti, M., Susanto, Y., Judijanto, L., Ali, M., Hartono, & Mahardhani, A. J. (2025). Determinants of sustainable employee performance: A study of family businesses in Indonesia. *Asia Pacific Management Review*, *30*(2), 100340. https://doi.org/https://doi.org/10.1016/j.apmrv.2024.12.004

MacNeil, A. (2025). Countering the institutionalization of harm reduction through critical pragmatism. *International Journal of Drug Policy*, *143*, 104872. https://doi.org/https://doi.org/10.1016/j.drugpo.2025.104872

Marks, D., & Miller, M. A. (2022). A transboundary political ecology of air pollution: Slow violence on Thailand's margins. *Environmental Policy and Governance*, *32*(4), 305–319. https://doi.org/https://doi.org/10.1002/eet.1976

Moya, E., Bryant, S. A., Horneck, N., Taylor, V., Alayleh, A., Alawa, J., Pintea, S. D., Lin, C., Bellaire, L. L., Saleh, J., & Shea, K. (2025). Advancing sustainability in healthcare: A scoping review of global recycling practices in operating rooms. *The American Journal of Surgery*, *241*, 116178. https://doi.org/https://doi.org/10.1016/j.amjsurg.2024.116178

Nagar, D., Nagar, S., & Chauhan, R. (2025). *Synergizing Bharat's Technological Wisdom and Dharmic Leadership: Pioneering Ethical Innovation in Digital Supply Chain Transformation BT - Flexibility and Emerging Perspectives in Digital Supply Chain Management* (S. Chaudhary, P. K. Suri, & K. Kapoor (eds.); pp. 285–303). Springer Nature Singapore. https://doi.org/10.1007/978-981-96-3556-6_15

Obasa, A. E. (2025). Navigating the storm: Ethical consideration to climate justice and sustainable health equity in Africa. *The Journal of Climate Change and Health*, *25*, 100465.

https://doi.org/https://doi.org/10.1016/j.joclim.2025.100465

Park, C. S.-Y. (2025). Ethical Artificial Intelligence in Nursing Workforce Management and Policymaking: Bridging Philosophy and Practice. *Journal of Nursing Management*, *2025*(1), 7954013. https://doi.org/https://doi.org/10.1155/jonm/7954013

Prezza, M., & Pacilli, M. G. (2007). Current fear of crime, sense of community, and loneliness in italian adolescents: The role of autonomous mobility and play during childhood. *Journal of Community Psychology*, *35*(2), 151–170. https://doi.org/https://doi.org/10.1002/jcop.20140

Robins, J., & Wiersema, M. F. (1995). A resource-based approach to the multibusiness firm: Empirical analysis of portfolio interrelationships and corporate financial performance. *Strategic Management Journal*, *16*(4), 277–299. https://doi.org/https://doi.org/10.1002/smj.4250160403

Thompson, T. W. (2025). Does Culture Eat Talent? A Quantitative Study Exploring the Relationship Between Organizational Culture and Turnover Intentions in Conservation Organizations. *Seu.Edu*.

Wang, S. L., Sun, J., & Schreck, S. (2025). Turning accidents into advantages: An actionable framework for accidental corporate social responsibility. *Business Horizons*. https://doi.org/https://doi.org/10.1016/j.bushor.2025.07.006