

Can the transformational leadership support sustainability practice through digital transformation on the Saudi civil aviation sector?

Mohammed Fahad Al-Qahtani

Cairo University

Hend Naguib

hend_naguib@foc.cu.edu.eg

Cairo University

Research Article

Keywords: Transformational leadership, Digital transformation, Sustainability practices, Saudi civil aviation sector

Posted Date: October 23rd, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11167554/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Transformational leadership has gained a great attention in the past and still hold significant importance in the present, especially in modern business environment. This study aims to identify the role of digital transformation in the relationship between transformational leadership practices and sustainability in the Saudi civil aviation sector. The study employed a quantitative method, using a questionnaire administered to a sample of 387 employees. The results showed very high levels of transformational leadership, led by inspirational motivation; digital transformation, led by administrative automation; and sustainability practice, with economic and environmental sustainability jointly ranking first. Correlation analyses revealed positive relationships between transformational leadership and sustainability, between transformational leadership and digital transformation, and between digital transformation and sustainability. Structural equation modelling confirmed the partial mediating role of digital transformation, with a direct effect of 0.173, an indirect effect of 0.656 and a total effect of 0.829, supported by excellent fit indices (CFI = 0.993; RMSEA = 0.055). The study recommends integrating transformational leadership practices with technological infrastructure to support environmental, economic and social sustainability.

Introduction

Despite the growing recognition of the importance of transformational leadership, digital transformation and sustainability practices, a research gap persists in understanding how these factors interact. In other words, previous studies haven't reached a consensus on the nature of the relationship between the variables. Although, transformational leadership has widely been studied in literature, there is a need for further studies to connect transformational leadership with digital transformation. From one hand, there is an increasing move toward digital transformation and that move needs to determine the appropriate leadership style that enhance this step. From the other hand, previous studies suggested that digital transformation can support sustainability practices. However, this is not the case in all situations, nor to the same degree across all sectors [61, 64, 65, 78].

Some previous studies suggested that transformational leadership and digital transformation can support sustainability because this style inspires and motivates employees towards higher performance and the adoption of the sustainability values and goals, while digital transformation the integration of digital technology across all aspects of business, so it can increase returns, decrease the environmental pollution, and achieving justice [3, 6].

Transformational leadership, first introduced by Burns [19] and subsequently developed by Bass [14], is a leadership style that emphasises the leader's role in inspiring and motivating followers to achieve exceptional outcomes. It comprises four principal components: idealised influence, whereby leaders act as ethical role models who foster trust and respect among their followers [52]; inspirational motivation, which involves articulating a compelling vision that provides a sense of purpose and directs collective efforts towards organisational objectives; intellectual stimulation, which encourages followers to

challenge existing assumptions and embrace innovative approaches, thereby fostering a culture of creativity and problem-solving [40]; and individualised consideration, whereby the leader attends to each follower's needs and individual development. Collectively, these components enable transformational leaders to enhance followers' performance and strengthen their organisational commitment [12].

Digital transformation (DT) refers to the development of new products or services driven by increasing innovation and the use of digital technologies, provided that it is grounded in a comprehensive business strategy [68]. Its application is not confined to a single field or sector [69] but extends across the organisation as a whole, enabling the development of new sustainable business models that still require legitimacy in order to be accepted [17]. Companies seeking sound economic performance endeavour to meet their economic, environmental and social requirements [16], integrating sustainability into their corporate strategies to reduce environmental impacts, achieve commercial benefits and enhance performance and competitiveness within their markets [37].

Achieving sustainability in air transport is very important. It is a vital element in connecting nations and transporting people and goods, and the level of its development serves as an indicator of a country's progress. Although distinguished by its speed, it faces considerable challenges, which have prompted international organisations to establish appropriate laws and regulations to govern it [8]. Adopting sustainability practices will help these organisations to save their resources, protect environment, improve the social justice [29].

Amid the rapid developments in the aviation sector, digital transformation has emerged as a pivotal factor in strengthening the relationship between transformational leadership and sustainability practices. Recent research suggests that the adoption of digital transformation technologies, such as artificial intelligence and big data analytics, plays a fundamental role in improving operational efficiency and reducing the environmental impact of airlines. For instance, a study examining the effect of digital transformation on the sustainability of EgyptAir revealed a moderate positive relationship between the application of these technologies and the achievement of sustainability within the organisation. Further studies have indicated that digital transformation can contribute to enhancing the institutional performance of airlines, by strengthening their capacity to adapt to environmental and economic changes [41].

Recent studies have demonstrated the effect of transformational leadership on many variables such as; innovation, sustainable performance and organisational resilience across diverse contexts [9, 20, 39, 74, 79]. While the relationship between transformational leadership, digital transformation, and sustainability still not enough. Therefore, some studies recommend to investigate the mediating role of digital transformation between transformational leadership and sustainability [23, 30, 33, 43, 45], as well as its role in the aviation sector [61, 64, 65, 78].

Thus, to address this gap, the study aims to determine if the digital transformation mediates the relationship between transformational leadership and sustainability practice in the Saudi civil aviation sector. This is pursued by measuring the levels of the three variables and their dimensions as perceived

by employees, testing the direct and indirect relationships among them, and deriving evidence-based recommendations for regulators and decision-makers. Based on the research objectives, this study aims to answer the following questions: (1) What is the level of transformational leadership, digital transformation and sustainability in the Saudi civil aviation sector? (2) Does the transformational leadership affect the sustainability practices? (3) Does digital transformation mediate this relationship?

More specifically, the study aimed to: analyse the effect of digital transformation, across its three dimensions, on enhancing sustainability practices in the sector; examine the relationship between the four dimensions of transformational leadership and the adoption of digital transformation; determine the extent to which digital transformation mediates the relationship between transformational leadership and sustainability practice; analyse the role of transformational leadership in advancing digital transformation within civil aviation work environments; provide recommendations to regulators and decision-makers on activating digital transformation; and offer an applied research framework transferable to other vital sectors.

This study contributes to the literature in two ways. Theoretically, it enriches the literature by addressing a knowledge gap concerning the mediating role of digital transformation between transformational leadership and sustainability practices, and offers an integrated research model of the interaction mechanisms among the three variables that opens avenues for future research. Practically, it enables organisations to determine whether transformational leadership is more efficient for digital solutions. It also, guide managers and decision makers to the practices that can not only support economic sustainability but also, support social and environmental sustainability through improved resource management and a reduced carbon footprint; clarifies how the four leadership dimensions foster more effective adoption of digital transformation; supports higher operational efficiency and lower costs; and strengthens the global competitiveness of Saudi organisations towards positioning the Kingdom as a global hub for sustainable air transport. The sector was selected for its centrality to the national economy – hosting 120 foreign airlines and targeting more than 330 million passengers annually – and for the environmental and economic challenges that render digitally enabled, leadership-driven sustainability a strategic imperative.

The paper is structured as follows. First, we began with an overview of the literature and the theoretical framework, starting with transformational leadership, sustainability practice and digital transformation and the hypothesised relations among them. Then we use a quantitative method to investigate these relations. Finally, we discussed the overall findings and the implications for both research and practice.

Literature review

Transformational leadership

The concept of transformational leadership evolved from Downton [26], was formulated by Burns [19] as a mutual elevation of leader and followers in motivation and morality, and was operationalised by Bass

[14] as leadership that transforms followers' values and drives them beyond self-interest towards higher goals [4]. Bass and Avolio [15] extended it through the Full Range Leadership Theory, within which measurement settled on the four-dimensional (42) model: idealised influence, inspirational motivation, intellectual stimulation and individualised consideration [35]. It is also defined as the extent to which leaders in the Saudi civil aviation sector practise transformational leadership behaviours as perceived by employees across the four dimensions, measured on a five-point Likert scale [74].

Sustainability practice

Sustainability originated in the Brundtland Commission's definition (1987) and was operationalised through Elkington's [27] Triple Bottom Line framework, comprising environmental, economic and social dimensions [51, 54]. Its salience is heightened in aviation owing to the operational and financial constraints of decarbonisation [28, 77]. Sustainability practice is operationally defined as the degree to which sector organisations adopt sustainability practices across the three dimensions, as perceived by employees.

Digital transformation

Digital transformation extends beyond digitisation and digitalisation to the reshaping of business models, organisational culture and decision-making structures [36, 59, 72]. It is operationally defined as the extent to which sector organisations apply digital transformation practices across three dimensions: administrative automation, innovation expansion and operational management [73].

Theoretical framework

Dynamic capabilities theory, transformational leadership and sustainability

The study draws upon the Dynamic Capabilities Theory [70] with its three processes of sensing, seizing and transforming, whereby digital transformation is interpreted as an enabling capability that activates the influence of transformational leadership towards sustainability through organisational reconfiguration [42, 58, 69].

The conceptual model and hypotheses

The model posits that transformational leadership (independent variable) affects sustainability practice (dependent variable) through a direct path and an indirect path mediated by digital transformation (Fig. 1), yielding four principal hypotheses:

Transformational leadership and sustainability practice

Some recent studies have suggested that transformational leadership can positively affect sustainability practices through several complementary mechanisms. Theoretically, transformational leaders are able to articulate a long-range vision that extends beyond short-term financial goals to encompass environmental and social commitments, and to inspire followers to internalise sustainable values and translate them into concrete behaviours. Abbas [1] found that transformational leadership positively affect firms' sustainable performance because he/she likes to preserve environment, resource conservation, and achieving justice between individuals. Also, some studies have indicated that transformational leadership Adopts a culture that support responsible environmental practice. Anggraini and Nainggolan [9], studying Indonesian small and medium-sized enterprises, confirmed a positive effect of transformational leadership on sustainable performance, they justified the result because transformational leaders stimulate innovation which in turn fosters more sustainable practices. In a related context, Majali et al. [48] demonstrated that transformational leadership positively affects the sustainable performance of small and medium-sized enterprises through green product innovation and a green entrepreneurial orientation.

This effect carries particular weight in civil aviation given mounting pressure on the sector to adopt sustainable practices and meet decarbonisation commitments. The World Economic Forum [77] identified visionary leadership and a sustained commitment to innovation as prerequisites for leading the sector's transition toward sustainability.

H1

Transformational leadership has a statistically significant positive effect on sustainability practice in the Saudi civil aviation sector.

Transformational leadership and digital transformation

The literature underscores the pivotal and decisive role of leadership in the digital-transformation, leadership failure being widely identified as a leading cause of such initiatives' failure. Gyamerah et al. [33] found that transformational leadership positively affects digital transformation in small and medium-sized enterprises by strengthening employees' digital capabilities and the underlying technical infrastructure, and that transformational leaders help build an organisational culture that encourages continuous learning, experimentation and risk acceptance — elements essential to successful digital transformation. Bindel Sibassaha et al. [18], studying the banking sector in the Republic of Congo, confirmed that transformational leadership strengthens the effect of digital transformation on employees' innovative work behaviour: leaders who communicate the digital-transformation vision effectively, provide support, and empower employees to embrace technological change enhance the innovative potential of their workforce. Dióssy et al. [25] found that the leadership style can affect achieving improvements in operational performance through its effect on digital transformation in the Hungarian manufacturing sector, while Alakaş [5] confirmed that transformational leadership and organizational positively affect digital transformation, because they can develop a successful digital

strategy and digital culture. QOCO [61] similarly reported that digital transformation in aviation operations requires a transformational leadership who has a vision encourage innovation, and partnerships, and this in turn will support digital transformation. Thus,

H2

Transformational leadership has a statistically significant positive effect on digital transformation in the Saudi civil aviation sector.

Digital transformation and sustainability practice

Although, a growing body of scientific and applied evidence supports a positive relationship between digital transformation and the achievement of sustainability objectives across sectors. This relationship needs more studies in different contexts. Digital technologies enable organisations to improve resource-use efficiency through smart monitoring and predictive analytics, support real-time, data-driven decision-making, and enhance transparency in environmental and social performance reporting. Asbeetah et al. [11] found that digital transformation positively affects sustainable organisational performance through two complementary mechanisms – green knowledge acquisition and innovation performance – noting that digital transformation facilitates access to specialised environmental knowledge and its application to process and product improvement. Mahmood et al. [47] confirmed the role of digital transformation in enhancing sustainability through green product innovation, and Arantes and Ferreira [10] identified sustainable-innovation strategies and digital transformation as key drivers of organisational sustainability in the contemporary environment.

In civil aviation specifically, this relationship is especially salient given the sector's distinctive environmental challenges. Xue et al. [78] found that digital technologies contribute to optimising flight paths and reducing fuel consumption and carbon emissions, while the International Energy Agency [38] confirmed the role of digital transformation in enabling the sector to meet decarbonisation targets through improved air-traffic management and the use of predictive analytics to raise operational efficiency. Global Market Insights [31] likewise reported that digital transformation helps the aviation sector address sustainability challenges, particularly with regard to carbon emissions and compliance with sustainable-fuel regulations.

H3

Digital transformation has a statistically significant positive effect on sustainability practice in the Saudi civil aviation sector.

The mediating role of digital transformation

The assumption that digital transformation mediates the relationship between transformational leadership and sustainability practice rests on established theoretical reasoning and converging

empirical evidence. Empirically, Cuevas-Vargas et al. [23] have studied the mediating role of digital transformation in the relationship between transformational leadership and sustainability practices among small and medium-sized enterprises in emerging economies: digital transformation produced the strongest indirect effect compared with innovation, underscoring its centrality as a conduit for leadership's influence, and the study confirmed that transformational leadership did not affect sustainability directly in these firms but through digital transformation and innovation. Geraldo-Campos et al. [30] likewise confirmed the mediating role of digital transformation in the relationship between transformational leadership and concern for society and social issues in Peru, concluding that firms seeking a socially responsible digital transformation must adopt an appropriate transformational leadership style. In a related context, Qiao et al. [60] found that digital transformation mediates the relationship between leadership and both job performance and organisational commitment, with digital leadership enhancing employee outcomes by driving a digital transformation that substantially amplifies leadership's positive effects.

This logic is reinforced in civil aviation, where digital transformation is an operational imperative for achieving the sector's ambitious sustainability commitments: digital technologies enable improved fuel efficiency through optimised flight paths and air-traffic management, reduced carbon emissions, an enhanced customer experience, and improved working conditions – outcomes that map directly onto the three dimensions of sustainability.

H4

Digital transformation mediates the relationship between transformational leadership and sustainability practice in the Saudi civil aviation sector.

Three sub-hypotheses derive from each of the first three principal hypotheses according to the dimensions of the dependent variable in each relationship: H1a, H1b and H1c posit statistically significant positive effects of transformational leadership on environmental, economic and social sustainability respectively; H2a, H2b and H2c posit statistically significant positive effects of transformational leadership on administrative automation, innovation expansion and operational management respectively; and H3a, H3b and H3c posit statistically significant positive effects of digital transformation on environmental, economic and social sustainability respectively.

Insert Fig. 1. here

Research methodology

Type of research

The study adopted the quantitative method owing to its suitability for the study's nature and objectives, as it describes the phenomenon as it exists in reality and collects and analyses data to answer the

research questions and test the hypotheses [7, 22], and examines and analyses the relationships between variables based on data gathered from the study population [62].

Data collection and measures

Primary data were collected through a questionnaire designed on a five-point Likert scale in light of the theoretical literature and previous studies, and distributed to employees of organisations within the sector.

The study began with defining the research problem and formulating its questions and hypotheses in light of the Saudi civil aviation sector's context and the identified research gaps, followed by constructing the theoretical framework from recent scholarly sources, developing the questionnaire to suit the sector's organisational environment, and verifying its psychometric properties through expert review and statistical testing. After delimiting the population and selecting a simple random sample according to the Krejcie and Morgan table, the questionnaire was distributed electronically. The data were then screened and prepared, and inferential analysis was conducted using structural equation modelling and path analysis with AMOS to test the direct and indirect relationships and the mediating role of digital transformation.

Sampling

The study population comprises all employees of Saudi civil aviation sector organisations, including airports, national carriers and supporting companies [2, 34], totalling approximately 65,000 employees according to data from the General Authority of Civil Aviation. This population was selected for its strategic importance in supporting the objectives of Saudi Vision 2030. Given the population's large size, a representative sample was selected using simple random sampling to ensure representativeness and generalisability [56, 57]. The sample size was determined at 387 respondents based on the Krejcie and Morgan [44] table, achieving a 95% confidence level and a 5% margin of error, and the electronic questionnaire was distributed to the full sample of 387 employees.

Statistical techniques

Data were analysed using SPSS (version 27) and AMOS for the mediation model, employing: frequencies and percentages to describe the demographic characteristics; means, standard deviations and relative weights for response levels; exploratory factor analysis (EFA), factor loadings, corrected item-total correlation (CITC) and Cronbach's alpha if item deleted (CAID) for item quality and construct validity; Cronbach's alpha and composite reliability (CR) for internal consistency; average variance extracted (AVE) for convergent validity; the Fornell–Larcker criterion for discriminant validity; Pearson's correlation coefficient to test the first three hypotheses; structural equation modelling (SEM) with path analysis to

examine the mediating role; the Sobel test for the significance of the indirect effect; and model fit indices (CMIN/DF, CFI, TLI, GFI, AGFI, NFI, RMSEA).

Analysis of result

Validity and reliability of the measures

The results demonstrated that the study instrument possesses strong psychometric properties. Exploratory factor analysis confirmed the suitability of the questionnaire items for measuring their respective dimensions, and all dimensions achieved high levels of internal consistency according to Cronbach's alpha and composite reliability, exceeding the accepted statistical thresholds. The average variance extracted (AVE) values surpassed the minimum criterion for convergent validity, and the Fornell–Larcker criterion confirmed the discriminant validity of the study variables, thereby affirming the instrument's suitability for data collection and hypothesis testing.

Descriptive analysis

To answer the research questions and define the means, standard deviations and relative weights were computed for the dimensions of the three variables on the five-point Likert scale. Transformational leadership recorded a “very high” overall level (M = 4.31, SD = 0.67, 86.3%), with inspirational motivation ranking first (4.37, 87.5%), followed by idealised influence (4.33, 86.5%), intellectual stimulation (4.30, 85.9%) and individualised consideration (4.26, 85.1%), as shown in Table 1. Digital transformation likewise recorded a “very high” level (M = 4.37, SD = 0.64, 87.5%), led by administrative automation (4.38, 87.6%), followed by innovation expansion (4.37, 87.5%) and operational management (4.36, 87.3%) (Table 2). Sustainability practice attained a “very high” level (M = 4.33, SD = 0.68, 86.6%); economic (4.34, 86.8%) and environmental (4.34, 86.7%) sustainability jointly ranked first, followed by social sustainability (4.32, 86.3%) (Table 3).

Table 1
Descriptive results for the dimensions of transformational leadership

Dimension	Mean	SD	Relative weight	Level	Rank
Idealised influence	4.33	0.64	86.5%	Very high	2
Inspirational motivation	4.37	0.72	87.5%	Very high	1
Intellectual stimulation	4.30	0.74	85.9%	Very high	3
Individualised consideration	4.26	0.70	85.1%	Very high	4
Overall score	4.31	0.67	86.3%	Very high	—
Source: authors’ fieldwork based on SPSS findings					

Table 2
Descriptive results for the dimensions of digital transformation.

Dimension	Mean	SD	Relative weight	Level	Rank
Administrative automation	4.38	0.64	87.6%	Very high	1
Innovation expansion	4.37	0.72	87.5%	Very high	2
Operational management	4.36	0.73	87.3%	Very high	3
Overall score	4.37	0.64	87.5%	Very high	—
Source: authors' fieldwork based on SPSS findings					

Table 3
Descriptive results for the dimensions of sustainability practice.

Dimension	Mean	SD	Relative weight	Level	Rank
Environmental sustainability	4.34	0.69	86.7%	Very high	1
Economic sustainability	4.34	0.69	86.8%	Very high	1
Social sustainability	4.32	0.73	86.3%	Very high	3
Overall score	4.33	0.68	86.6%	Very high	—
Source: authors' fieldwork based on SPSS findings					

Insert Table 1,2,3. here

Testing the study hypotheses

Pearson's correlation coefficient was used to test the first three hypotheses (Table 4). Statistically significant strong positive correlations were found between transformational leadership and sustainability practice ($r = 0.800$), including its environmental (0.771), economic (0.757) and social (0.786) dimensions; between transformational leadership and digital transformation ($r = 0.820$), including administrative automation (0.757), innovation expansion (0.786) and operational management (0.778); and between digital transformation and sustainability practice ($r = 0.865$), including its environmental (0.850), economic (0.816) and social (0.819) dimensions — all at a significance level of 0.000, which is below 0.05. Accordingly, H1, H2 and H3 and their sub-hypotheses were accepted.

Table 4
Pearson correlations between the study variables and their dimensions.

Relationship	r	Sig.	Decision
Transformational leadership × Environmental sustainability	0.771**	0.000	Significant
Transformational leadership × Economic sustainability	0.757**	0.000	Significant
Transformational leadership × Social sustainability	0.786**	0.000	Significant
Transformational leadership × Sustainability practice (overall)	0.800**	0.000	Significant
Transformational leadership × Administrative automation	0.757**	0.000	Significant
Transformational leadership × Innovation expansion	0.786**	0.000	Significant
Transformational leadership × Operational management	0.778**	0.000	Significant
Transformational leadership × Digital transformation (overall)	0.820**	0.000	Significant
Digital transformation × Environmental sustainability	0.850**	0.000	Significant
Digital transformation × Economic sustainability	0.816**	0.000	Significant
Digital transformation × Social sustainability	0.819**	0.000	Significant
Digital transformation × Sustainability practice (overall)	0.865**	0.000	Significant
<i>** Correlation is significant at the 0.01 level</i>			
Source: authors' fieldwork based on SPSS findings			

Insert Table 4. here

Testing the structure model

To test H4, structural equation modelling (SEM) with path analysis was employed, and the significance of the indirect effect was verified using the Sobel test (Table 5). The path from transformational leadership to digital transformation was significant ($\beta = 0.858$, $p = 0.000$), as was the path from digital transformation to sustainability practice ($\beta = 0.764$, $p = 0.000$). The direct effect of transformational leadership on sustainability practice remained significant after introducing the mediator ($\beta = 0.173$, $p = 0.002$); the indirect effect was 0.656 ($p = 0.000$) and the total effect was 0.829 ($p = 0.000$), indicating partial mediation, and H4 was therefore accepted. All model fit indices fell within the accepted statistical thresholds (Table 6), confirming the suitability of the structural model depicted in Fig. 1 for testing the study's hypotheses.

Table 5
Results of testing the mediating role of digital transformation.

Path	Coefficient (β)	Sig.	Decision
Transformational leadership → Digital transformation	0.858	0.000	Significant
Digital transformation → Sustainability practice	0.764	0.000	Significant
Transformational leadership → Sustainability practice (direct effect)	0.173	0.002	Significant
Indirect effect	0.656	0.000	Significant
Total effect	0.829	0.000	Significant
Source: authors' fieldwork based on AMOS findings			

Table 6
Goodness-of-fit indices of the structural model

Index	Computed value	Accepted threshold	Decision
CMIN/DF	2.16	Less than 5	Acceptable
CFI	0.993	Greater than 0.90	Acceptable
TLI	0.990	Greater than 0.90	Acceptable
GFI	0.988	Greater than 0.90	Acceptable
AGFI	0.982	Greater than 0.90	Acceptable
NFI	0.988	Greater than 0.90	Acceptable
RMSEA	0.055	Less than 0.08	Acceptable
Source: authors' fieldwork based on AMOS findings			

Discussion and implications

The very high level of transformational leadership reflects employees' conviction that sector leaders embody an ethical and professional exemplar, articulate an inspiring shared vision, activate followers' thinking and attend to their individual needs – a climate that prepares the organisation to embrace strategic transformations. These findings accord with Cuevas-Vargas [23] and Anggraini et al. [9], who demonstrated that leaders' ethical integrity and clear vision fuel innovation towards sustainable performance; with Wijaya [74], who showed that trust-based, intellectually stimulating leader behaviours generate an innovation-supportive climate; with Choi and Cho [20] on the centrality of hopeful, future-oriented communication to successful change management; and with Njaramba [53] and Asbeetah et al. [11] on the salience of intellectual stimulation and individualised consideration for employees' psychological capital, wellbeing and organisational commitment. They diverge partially from Yu and

Xiang [79], who found that leadership effects may slow under severe environmental uncertainty in the absence of organisational resilience, whereas the present results indicate a direct, robust effect owing to the stability of the sector's strategy; and from Jabbour Al Maalouf et al. [39], where leadership fostered venture-driven exploratory innovation, while the Saudi sector channels stimulation towards prudent operational innovation that balances digital transformation with strict aviation-safety standards.

The advanced digital maturity, led by administrative automation, is consistent with Barrera [13] and Splunk [66] on the efficiency gains of automation and predictive analytics; with Gyamerah et al. [33] and Kludacz-Alessandri et al. [43] on the roles of digital transformational leadership and organisational flexibility in intensifying digital transformation; and with Verhoef et al. [71], SITA [64] and the World Economic Forum [77] on reimagining business models and digital-by-design structures. The very high sustainability level accords with Silva et al. [63] and Deloitte [24] on engaged workforces and human sustainability; with Elkington [27], Nogueira et al. [54] and Mishra and Pandey [51] on the Triple Bottom Line and its integration with governance standards; with the World Economic Forum [76] and Circle Economy Foundation [21] on the value of circular-economy models; and with Xue et al. [78] and the IEA [38] on decarbonisation imperatives.

The hypothesis results corroborate Abbas [1] and Majali et al. [48] on leadership's role in cultivating sustainability-supportive cultures (H1); Alakaş [5], Bindel Sibassaha et al. [18] and Dióssy et al. [25] on leadership as the driver of digital transformation (H2); and Mahmood et al. [46], Arantes and Ferreira [10] and Global Market Insights [31] on digitalisation as an enabler of sustainability (H3). The partial mediation (H4) provides direct empirical support for Cuevas-Vargas [23], Geraldo-Campos et al. [30], Qiao et al. [60], Mahendra et al. [46] and Mamudu et al. [49], which position digital transformation as the strategic conduit translating leadership vision into tangible sustainable outcomes. The persistence of the significant direct effect reflects the values-based dimension of leadership that complements technology, consistent with Martínez-Peláez et al. [50] and Winasisa et al. [75] on the human–stakeholder interface, and with Guandalini [32] and Nosratabadi et al. [55], which frame digital transformation as a means to comprehensive sustainability rather than an end in itself.

Theoretical contribution

This study is contributing to the theory in two ways. First, most of the previous studies were interested in investigating the effect of transformational leadership and digital transformation on sustainability separately, while a research gap persisted in understanding how these factors interact. Thus, this study tried to overcome this gap in the literature by explaining how transformational leadership is related to sustainability by investigating the mediating role of digital transformation between transformational leadership and sustainability practices, offering an integrated research model of the interaction mechanisms among the three variables – interpreted through the dynamic capabilities theory – that opens avenues for future research. Second, this study holds up in a different culture and industry the Saudi civil aviation sector, as GaybullaeV and Strode [29] have reported that most of the studies held in

China and Pakistan especially in education, manufacturing and banking sector, while studying these relationship in the transportation industry is very limited.

Practical implications

This study provides insights into practitioners, regulators and decision-makers in the Saudi civil aviation sector. The study recommended that strengthening civil aviation sustainability needs a transformational leadership training programs oriented towards individualised consideration, inspiration, intellectual motivation, activating leadership innovation laboratories. These objects will enhance accelerating administrative automation. Also, they need allocating dedicated budgets for digital innovation expansion. All these things will help the civil aviation organisations to achieve economic, environmental, social sustainability. linking leaders' incentives to sustainability objectives, employing digital transformation to decrease resource consumption, and raising the return on investment of digital transformation projects will be easier if they have a recruitment and retention plan to keep transformational leaders in their organisations.

The current research has a number of limitations that should be taken into account when generalising the findings: (1) the study was confined spatially to the Kingdom of Saudi Arabia (Riyadh); (2) temporally to the year 2026; (3) humanly to employees of Saudi civil aviation sector organisations; and (4) topically to the three study variables – transformational leadership, digital transformation and sustainability practice. Future studies can be implemented to address digital leadership and organisational resilience, strategic agility as a moderating variable, digital transformation governance, green aviation, the ethics of artificial intelligence, and the role of big data and blockchain in supporting sustainability.

Conclusion

Taken together, the findings demonstrate very high levels of transformational leadership, digital transformation and sustainability practice in the Saudi civil aviation sector, and confirm that digital transformation partially mediates the relationship between transformational leadership and sustainability practice. This affirms that the integration of transformational leadership and the digital ecosystem constitutes the optimal formula for the sector's sustainability.

Declarations

Author Contribution

Authors' contributions: MFA developed the research framework, participated in collecting and analyzing data, and was a major contributor to writing the manuscript. HMN supervised the research process from the development of the idea; she also participated in writing the manuscript. All authors read and approved the final manuscript.

Abbreviations

DT Digital transformation

SEM Structural equation modelling

EFA Exploratory factor analysis

CITC Corrected item-total correlation

CAID Cronbach's alpha if item deleted

CR Composite reliability

AVE Average variance extracted

CFI Comparative fit index

TLI Tucker–Lewis index

GFI Goodness-of-fit index

AGFI Adjusted goodness-of-fit index

NFI Normed fit index

RMSEA Root mean square error of approximation

References

1. Abbas, J. (2024). Green supply chain management and firm sustainable performance: Unlocking the role of transactional and transformational leadership in firm sustainable operations. *Environment, Development and Sustainability*, 1(3), 1–17. <https://doi.org/10.1007/s10668-024-05035-0>
2. Abu Allam, R. (2009). *Research methods in psychological and educational sciences* (6th ed.). Dar Al-Nashr Lil-Jamiat. [In Arabic]
3. Abu Saadeh, A. A. (2024). Digital transformation as a mediating variable between administrative reform and sustainable development: A field study on Misr Insurance Company. *Journal of Administrative Research*, 42(2), 1–44. [In Arabic]
4. Agazu, B., Kero, C., & Debela, K. (2025). Transformational leadership and firm performance: A systematic literature review. *Journal of Innovation and Entrepreneurship*, 14, 1023–1046. <https://doi.org/10.1186/s13731-025-00476-x>
5. Alakaş, E. (2024). Digital transformational leadership and organizational agility in digital transformation: Structural equation modelling of the moderating effects of digital culture and digital

- strategy. *The Journal of High Technology Management Research*, 35(2), 1–15.
<https://doi.org/10.1016/j.hitech.2024.100517>
6. Al-Dabbas, A. I. (2022). The impact of digital transformation requirements on human resource management practices in the Jordanian government services sector [Unpublished master's thesis]. Amman Arab University. [In Arabic]
 7. Al-Mahmoudi, M. S. A. (2019). *Scientific research methods* (3rd ed.). Dar Al-Kutub. [In Arabic]
 8. Al-Sahli, F. S. (2020). The scope and basis of air carrier liability for passengers under the Saudi civil aviation law. *Journal of the College of Sharia and Law*, 22(1), 569–612. [In Arabic]
 9. Anggraini, R., Andrian, M., & Nainggolan, F. (2025). The role of transformational leadership on sustainable performance mediated by innovation. *Jurnal Manajemen (Edisi Elektronik)*, 16(2), 316–338. <https://doi.org/10.32832/jm-uika.v16i2.18804>
 10. Arantes, L., & Ferreira, J. (2025). Innovative sustainability strategies and the role of digital transformation in organisations. *Corporate Social Responsibility and Environmental Management*, 32(3), 3088–3121. <https://doi.org/10.1002/csr.3123>
 11. Asbeetah, Z., Alzubi, A., Khadem, A., & Iyiola, K. (2025). Harnessing digital transformation for sustainable performance: Exploring the mediating roles of green knowledge acquisition and innovation performance under digital transformational leadership. *Sustainability*, 17(5), 1–19. <https://doi.org/10.3390/su17052285>
 12. Bakker, A., Hetland, J., Kjellefold Olsen, O., & Espevik, R. (2023). Daily transformational leadership: A source of inspiration for follower performance? *European Management Journal*, 41(5), 700–708. <https://doi.org/10.1016/j.emj.2022.04.004>
 13. Barrera, M. (2025). Transformation of administrative management through emerging technologies and digital innovation. *Diginomics*, 4, 1–22. <https://doi.org/10.56294/digi2025204>
 14. Bass, B. (1985). *Leadership and performance beyond expectations*. Free Press.
 15. Bass, B., & Avolio, B. (Eds.). (1994). *Improving organizational effectiveness through transformational leadership*. SAGE Publications.
 16. Benites, L., & Polo, E. (2013). Sustainability as business strategic: The corporate governance and application of the triple bottom line in Masisa. *Rev Adm UFSM*, 6, 195–210.
 17. Biloslavo, R., Bagnoli, C., Massaro, M., & Cosentino, A. (2020). Business model transformation toward sustainability: The impact of legitimation. *Management Decision*, 58(8), 1643–1662.
 18. Bindel Sibassaha, J., Pea-Assounga, J., & Bambi, P. (2025). Influence of digital transformation on employee innovative behavior: Roles of challenging appraisal, organizational culture support, and transformational leadership style. *Frontiers in Psychology*, 16, 1023–1036. <https://doi.org/10.3389/fpsyg.2025.1532977>
 19. Burns, J. (1978). *Leadership*. Harper & Row.
 20. Choi, B., & Cho, K. (2024). Influence of transformational leadership on innovative behavior in the Korean public service sector: The moderated mediating effect of change management and PSM.

- Public Performance & Management Review, 48(2), 437–467.
<https://doi.org/10.1080/15309576.2024.2436631>
21. Circle Economy Foundation. (2024). Circularity Gap Report 2024. <https://www.circularity-gap.world/2024>
 22. Creswell, J., & Creswell, J. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). Sage Publications.
 23. Cuevas-Vargas, H. (2025). Linking transformational leadership to sustainability outcomes: The mediating roles of digital transformation and innovation. *Corporate Social Responsibility and Environmental Management*, 32(5), 6016–6030. <https://doi.org/10.1002/csr.70020>
 24. Deloitte. (2024). 2024 Global Human Capital Trends: Thriving beyond boundaries: Human performance in a boundaryless world. Deloitte Insights.
<https://www.deloitte.com/us/en/insights/topics/talent/human-capital-trends/2024.html>
 25. Dióssy, K., Losonci, D., Aranyossy, M., & Demeter, K. (2025). The role of leadership in digital transformation – a paradox way to improve operational performance. *Journal of Manufacturing Technology Management*, 36(9), 88–113. <https://doi.org/10.1108/JMTM-07-2024-0386>
 26. Downton, J. (1973). Rebel leadership: Commitment and charisma in the revolutionary process. Free Press.
 27. Elkington, J. (1994). Towards the sustainable corporation: Win–win–win business strategies for sustainable development. *California Management Review*, 36(2), 90–100.
<https://doi.org/10.2307/41165746>
 28. European Union Aviation Safety Agency. (2025). European Aviation Environmental Report 2025.
<https://www.easa.europa.eu/en/light/topics/european-aviation-environmental-report-2025>
 29. Gaybullae, O., & Strode, J. P. (2026). Transformational leadership and organizational sustainability performance: A systematic literature review of global evidence. *Environment, Development and Sustainability*, 1–49.
 30. Geraldo-Campos, L., Mascaro-Canales, P., Salas-Tenesaca, E., & Tito-Huamani, P. (2025). Transformational leadership and corporate social responsibility: The mediating role of digital transformation. *Problems and Perspectives in Management*, 23(3), 751–765.
[http://dx.doi.org/10.21511/ppm.23\(3\).2025.53](http://dx.doi.org/10.21511/ppm.23(3).2025.53)
 31. Global Market Insights Inc. (2025). Top challenges confronting the aviation sector in 2025 and beyond. <https://www.gminsights.com/blogs/top-challenges-of-aviation-industry>
 32. Guandalini, I. (2022). Sustainability through digital transformation: A systematic literature review for research guidance. *Journal of Business Research*, 148, 456–471.
<https://doi.org/10.1016/j.jbusres.2022.05.003>
 33. Gyamerah, S., Afshari, L., & Asante, D. (2025). Digital transformation in the SME context: The nexus between leadership, digital capabilities and digital strategy. *International Small Business Journal*, 43(3), 303–328. <https://doi.org/10.1177/02662426251314108>

34. Hamdi, M. A., & Stoutah, S. (2019). Research methods in media and communication sciences: The method of preparing research. Al-Hamed. [In Arabic]
35. Hariyani, D., Hariyani, P., & Mishra, S. (2025). The role of leadership in sustainable digital transformation of the organization. *Sustainable Futures*, 10, 101–126.
<https://doi.org/10.1016/j.sftr.2025.101130>
36. Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2020). Options for formulating a digital transformation strategy. In R. D. Galliers, D. E. Leidner, & B. Simeonova (Eds.), *Strategic information management: Theory and practice* (5th ed., pp. 151–173). Routledge. <https://doi.org/10.4324/9780429286797-7>
37. Hsu, C. C., Tsaih, R. H., & Yen, D. C. (2018). The evolving role of IT departments in digital transformation. *Sustainability*, 10(10), 3706.
38. International Energy Agency. (2025). Aviation. IEA. <https://www.iea.org/energy-system/transport/aviation>
39. Jabbour Al Maalouf, N., El Achi, S., & Balouza, M. (2025). Transformational leadership, innovation, and performance of SMEs in Europe. *Cogent Business & Management*, 12(1), 215–246.
<https://doi.org/10.1080/23311975.2025.2473683>
40. Kanat-Maymon, Y., Elimelech, M., & Roth, G. (2020). Work motivations as antecedents and outcomes of leadership: Integrating self-determination theory and the full range leadership theory. *European Management Journal*, 38(4), 555–564.
41. Khalaf, A. A. E., & Abdelrady, H. A. (2023). Impact of digital transformation technologies on EgyptAir sustainability. *Journal of Association of Arab Universities for Tourism and Hospitality*, 24(1), 44–61.
42. Khatib, O. Y. M. (2022). Dynamic capabilities and their impact on digital transformation: The moderating role of electronic customer relationship management and strategic renewal as a mediating variable in Palestinian universities [Unpublished doctoral dissertation]. The World Islamic Sciences and Education University. [In Arabic]
43. 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), 134–158. <https://doi.org/10.1186/s12913-025-12283-x>
44. Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607–610.
45. Ly, B. (2024). The interplay of digital transformational leadership, organizational agility, and digital transformation. *Journal of the Knowledge Economy*, 15, 4408–4427.
<https://doi.org/10.1007/s13132-023-01377-8>
46. Mahendra, A. I., Muttaqijn, M. I., & Hadiwijaya, D. (2024). Corporate culture and transformational leadership on corporate sustainable performance mediated by digital transformation. *International Journal of Business Economics (IJBE)*, 5(2), 50–64.
47. Mahmood, G., Ditta, A., Ramzan, M., & Abbas, Z. (2024). Role of artificial intelligence (AI) adoption and digital transformation in enhancing sustainable business performance: The mediating effect of

- green product innovation. *Journal of Accounting and Finance in Emerging Economies*, 10(4), 519–532. <https://doi.org/10.26710/jafee.v10i4.3172>
48. Majali, T., Alkaraki, M., Asad, M., Aladwan, N., & Aledeinat, M. (2022). Green transformational leadership, green entrepreneurial orientation and performance of SMEs: The mediating role of green product innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(4), 191. <https://doi.org/10.3390/joitmc8040191>
 49. Mamudu, U., Obasi, C., Awuye, S., Danso, H., Ayodele, P., & Akinyemi, P. (2024). Circular economy in the manufacturing sector: Digital transformation and sustainable practices. *International Journal of Science and Research Archive*, 12(2), 129–141.
 50. Martínez-Peláez, R., Ochoa-Brust, A., Rivera, S., Félix, V., Ostos, R., Brito, H., & Mena, L. J. (2023). Role of digital transformation for achieving sustainability: Mediated role of stakeholders, key capabilities, and technology. *Sustainability*, 15(14), 11221. <https://doi.org/10.3390/su151411221>
 51. Mishra, P., & Pandey, V. (2025). Triple bottom line and environmental sustainability: Evolution of global ESG research—a bibliometric analysis. *Environmental Sciences Europe*, 37, 1–28. <https://doi.org/10.1186/s12302-025-01184-9>
 52. Nassif, A. G., Hackett, R. D., & Wang, G. (2021). Ethical, virtuous, and charismatic leadership: An examination of differential relationships with follower and leader outcomes. *Journal of Business Ethics*, 172(3), 581–603.
 53. Njaramba, F. (2024). Transformational leadership in a crisis: Dimensional analysis with psychological capital. *Heliyon*, 10(16), 1–16. <https://doi.org/10.1016/j.heliyon.2024.e35900>
 54. Nogueira, E., Gomes, S., & Lopes, J. (2025). Unveiling triple bottom line's influence on business performance. *Discover Sustainability*, 6, 43–49. <https://doi.org/10.1007/s43621-025-00804-x>
 55. Nosratabadi, S., Atobishi, T., & Hegedűs, S. (2023). Social sustainability of digital transformation: Empirical evidence from EU-27 countries. *Administrative Sciences*, 13(5), 126.
 56. Obeidat, T., Adas, A., & Abdel Haq, K. (2011). *Scientific research: Its concept, tools and methods* (14th ed.). Dar Al-Fikr. [In Arabic]
 57. Omar, S. I. S. (2009). *A concise guide to scientific research methodology in education and the humanities*. Dar Al-Fikr. [In Arabic]
 58. Ortiz-Avram, D., Ovcharova, N., & Engelmann, A. (2024). Dynamic capabilities for sustainability: Toward a typology based on dimensions of sustainability-oriented innovation and stakeholder integration. *Business Strategy and the Environment*, 33(4), 2969–3004. <https://doi.org/10.1002/bse.3630>
 59. Plekhanov, D., Franke, H., & Netland, T. (2023). Digital transformation: A review and research agenda. *European Management Journal*, 41(6), 821–844. <https://doi.org/10.1016/j.emj.2022.09.007>
 60. Qiao, G., Li, Y., & Hong, A. (2024). The strategic role of digital transformation: Leveraging digital leadership to enhance employee performance and organizational commitment in the digital era. *Systems*, 12(11), 1–33. <https://doi.org/10.3390/systems12110457>

61. QOCO. (n.d.). Navigating digital transformation in aviation operations: A guide for top leadership in 2024. <https://www.qoco.aero/blog/navigating-digital-transformation-in-aviation-operations-a-guide-for-top-leadership-in-2024>
62. Saunders, M., Lewis, P., & Thornhill, A. (2023). *Research methods for business students* (9th ed.). Pearson.
63. Silva, D., Wehrmeyer, W., & Murphy, R. (2025). Managing organisational sustainability and corporate social responsibility: Perspectives for sustainable development. *Circular Economy and Sustainability*. <https://doi.org/10.1007/s43615-025-00508-4>
64. SITA. (2025). From revenue to impact: Aviation industry transformation clearly reflected in SITA's record results. <https://www.sita.aero/pressroom/news-releases/aviation-industry-transformation-clearly-reflected-in-sitas-record-results/>
65. Skift. (2024). Q&A: Airlines double down on digitization and sustainability. <https://skift.com/2024/12/10/airlines-double-down-on-digitization-and-sustainability/>
66. Solis, B. (2021). Digital transformation in 2021 and beyond – A prediction. <https://briansolis.com/2021/01/digital-transformation-in-2021-and-beyond-a-prediction/>
67. Splunk. (n.d.). Digital transformation in 2026: Strategies, benefits, & real-world examples. https://www.splunk.com/en_us/blog/learn/digital-transformation
68. Tabrizi, B., Lam, E., Girard, K., & Irvin, V. (2019). Digital transformation is not about technology. *Harvard Business Review*. <https://hbr.org/2019/03/digital-transformation-is-not-about-technology>
69. Teece, D. (2023). The evolution of the dynamic capabilities framework. In R. Adams, D. Grichnik, A. Pundziene, & C. Volkmann (Eds.), *Artificiality and sustainability in entrepreneurship* (pp. 113–129). Springer. https://doi.org/10.1007/978-3-031-11371-0_6
70. Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533.
71. Verhoef, P., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889–901. <https://doi.org/10.1016/j.jbusres.2019.09.022>
72. Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, 28(2), 118–144. <https://doi.org/10.1016/j.jsis.2019.01.003>
73. Warner, K., & Wäger, M. (2019). Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal. *Long Range Planning*, 52(3), 326–349. <https://doi.org/10.1016/j.lrp.2018.12.001>
74. Wijaya, N. (2025). Extending the transformational leadership–innovative work behavior relationship: Integrating climate for innovation and dissimilarities in dyad relational demography. *Journal of Leadership & Organizational Studies*, 32(1), 34–48. <https://doi.org/10.1177/15480518241301237>
75. Winasisa, S., Djumarno, Riyanto, S., & Ariyanto, E. (2021). The effect of transformational leadership climate on employee engagement during digital transformation in Indonesian banking industry. *International Journal of Data and Network Science*, 5, 91–96.

76. World Economic Forum. (2024). The circular transformation of industries: Unlocking economic value. <https://www.weforum.org/stories/2024/12/value-in-business-shift-to-circular-value-chains/>

77. World Economic Forum. (2025). Global Aviation Sustainability Outlook 2025. <https://www.weforum.org/publications/global-aviation-sustainability-outlook-2025/>

78. Xue, D., Chen, X., & Yu, S. (2025). Sustainable aviation for a greener future. *Communications Earth & Environment*, 6, Article 233. <https://doi.org/10.1038/s43247-025-02222-3>

79. Yu, J., & Xiang, K. (2025). Transformational leadership, organizational resilience, and team innovation performance: A model for testing moderation and mediation effects. *Behavioral Sciences*, 15(1), 102–136. <https://doi.org/10.3390/bs15010010>

Figures

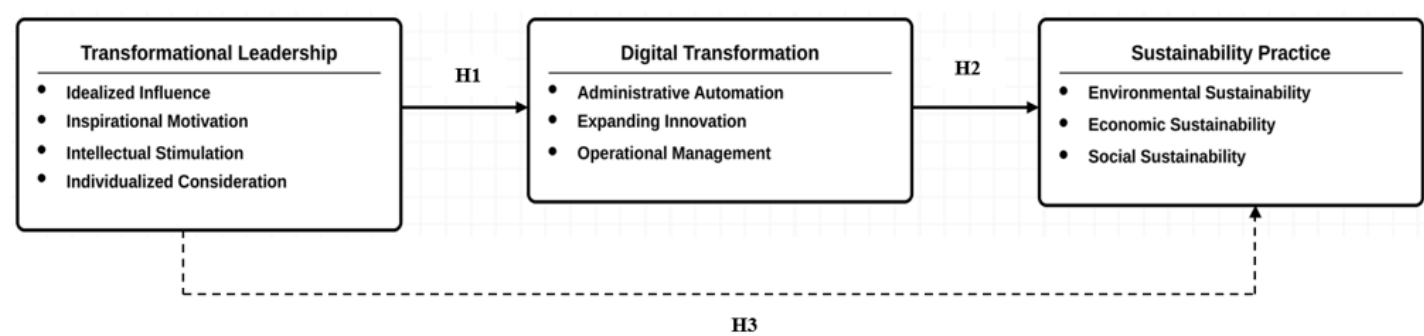


Figure 1

conceptual framework

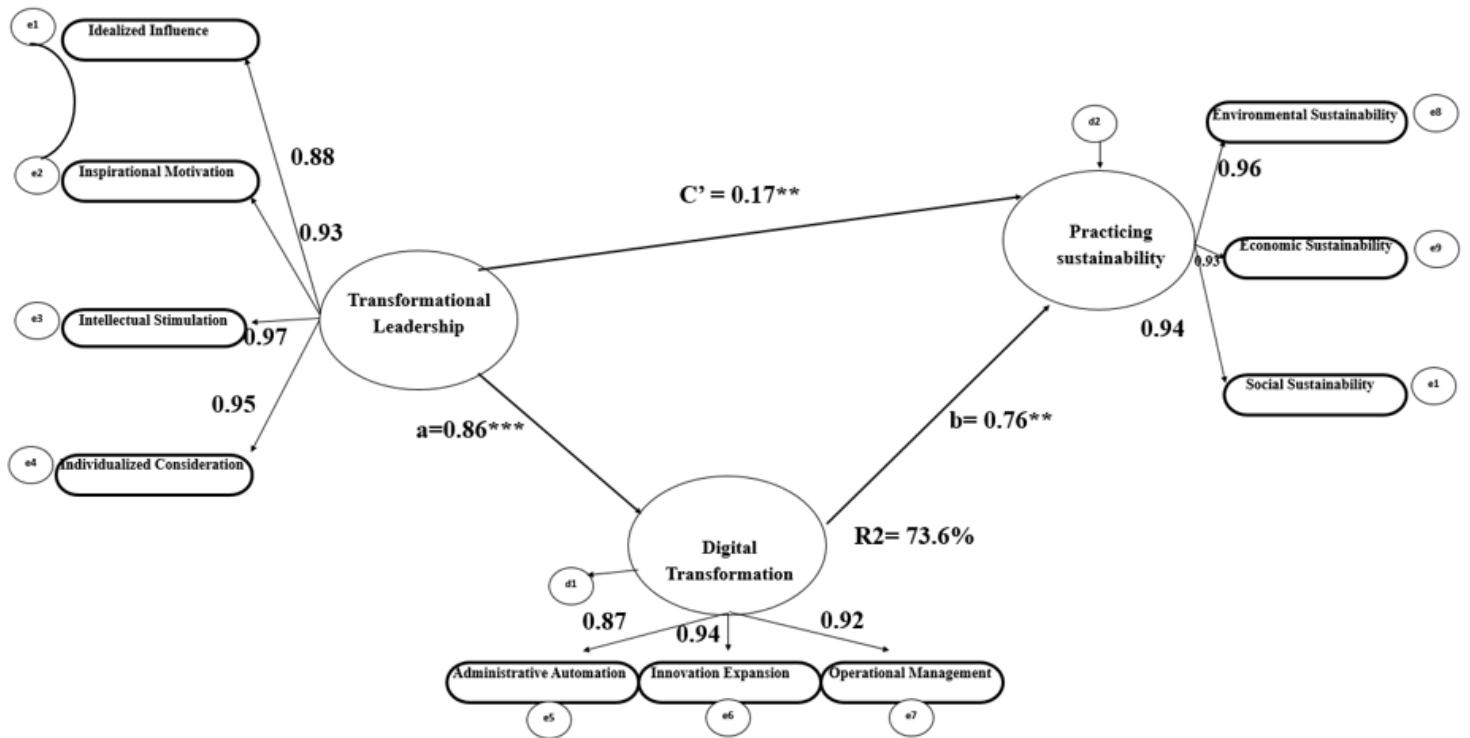


Figure 2

testing the model structure

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Appendix.docx](#)