

RESEARCH PAPER

The Role of Digital Leadership in The Sustainable Performance of Egyptian Telecommunications Companies: The Mediating Effect of Digital Organizational Culture

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ABSTRACT

This paper focuses on mobile telecommunication companies (MTCs) in Egypt to investigate the impact of digital leadership (DL) on sustainable performance (SP). The mediating role played by digital organizational culture (DOC) in the relationship between DL and SP is also examined. The survey method is employed to conduct this research, and data is collected from 331 respondents. The proposed hypotheses are tested using structural equation modeling and analyzed using structural equation modeling Smart PLS V.4. The results indicate that DL directly influences DOC. SP and DOC partially mediate the relationship between DL and SP. Previous research has not extensively examined the mediating role of DOC in the relationship between DL and SP. This research is one of the first studies to demonstrate that DL positively impacts the SP of Egyptian MTCs through the mediating role of DOC.

KEYWORDS: Digital leadership; Digital organizational culture; Sustainable performance.

1. Introduction

DL and DOC play crucial roles in the transformation of Egyptian MTCs. Digital leadership (DL) refers to the ability of leaders to drive digital transformation and innovation within organizations [1, 2]. In the context of Egypt's public sector, digital transformation has become a government trend supported by political leaders, focusing on digitizing government activities and improving customer experiences [3]. DOC encompasses the values, beliefs, and practices that support digital innovation and transformation within a company [4, 5]. In the telecommunications sector, which has been significantly impacted by digital disruption, developing a digital culture is essential for incumbent firms to remain competitive [1, 2]. Interestingly, while DL and organizational culture are crucial for digital transformation, their implementation in Egyptian MTCs may face challenges. The public sector in Egypt has identified several factors affecting digital transformation, including financial capabilities, infrastructure availability, organizational culture, and employee skillsets [3]. These factors may also apply to MTCs, requiring a holistic

approach to digital transformation.

The phenomenon of sustainability has rapidly gained prominence across various sectors, including telecommunications, where companies face unique challenges and opportunities in their quest for responsible operation. In Egypt, the telecommunications industry has experienced remarkable growth over the last two decades, significantly contributing to the national economy, fostering innovation, and enhancing social connectivity [6]. However, this growth has often come at the expense of environmental and social responsibilities, raising concerns about the SP of MTCs [7]. It is imperative to explore the current state of sustainability within Egyptian MTCs, evaluating their environmental practices, social responsibility initiatives, and economic contributions. Moreover, as globalization intensifies and regulatory frameworks evolve, Egyptian telecommunications firms are increasingly pressured to adopt sustainable practices that align with global standards [8]. The integration of sustainable practices into operational models is not only crucial for compliance and corporate reputation but also serves as a competitive advantage in a rapidly changing market landscape

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[9]. By employing innovative technologies aimed at reducing carbon footprints and enhancing energy efficiency, these companies can pave the way for a more sustainable future [10].

Thus, it is essential to investigate how DL not only drives the implementation of sustainable practices but also influences the organizational culture necessary for long-term success. Understanding these dynamics can provide valuable insights for telecom leaders aiming to navigate the complexities of the digital age while contributing positively to Egypt's economic and social landscape. The following sections will delve deeper into the interplay between DL, DOC, and SP, demonstrating how this triad can position Egyptian *MTCs* for thriving futures in an increasingly competitive market.

Therefore, this study analyzes how DL impacts the SP of Egyptian telecom companies through DOC. Specifically, this study aims to answer the following four research questions:

RQ1. How can DL help to increase the SP of Egyptian *MTCs*?

RQ2. How can DL help to create and share DOC of Egyptian *MTCs*?

RQ3. How can DOC help to develop the SP of Egyptian *MTCs*?

RQ4. How can DL help to increase the SP of Egyptian *MTCs* through DOC?

Hence, this study has four research objectives. First, it investigates the exploring effect of DL on DOC of Egyptian *MTCs*. Second, it clarifies the relationships among DL and SP. Third, it clarifies the relationships among DOC achieving SP of Egyptian telecommunications companies. Finally, exploring the mediating effect of DOC in the relationship between DL and achieving SP of Egyptian telecommunications companies.

2. Literature Review, Research Hypotheses, and Framework

2.1. Digital leadership

DL is a critical concept in the modern business landscape, characterized by the ability to lead and utilize technology effectively in organizational settings [11]. It encompasses formulating a vision that integrates technology into business strategy, building a culture of innovation, developing employees' digital skills, focusing on customers, and creating organizational flexibility [12]. Digital leaders possess distinct abilities and

perspectives compared to traditional leaders, including digital strategic thinking, digital insight, digital change management, and digital talent development. They are characterized by vision motivation, digital empowerment, innovation and entrepreneurship, cross-boundary collaboration, and dynamic adaptation [13]. Interestingly, DL is not solely about understanding technology but also about optimizing digital assets to accomplish business objectives and drive digital transformation [11]. In the context of *MTCs*, DL encompasses a variety of skills, including data-driven decision-making, agility in response to market trends, and a vision for integrating technology into business processes.

2.2. Digital organizational culture

Digital organizational culture (DOC) refers to the set of shared values, beliefs, attitudes, and behaviors that shape an organization's approach to digital transformation and technology adoption. It encompasses the integration of digital technologies into all aspects of business operations and the development of a mindset that embraces innovation, agility, and continuous learning in the digital era [14, 15]. It fosters agility, collaboration, and data-driven decision-making, while emphasizing the importance of leadership, employee engagement, and communication in cultivating a digital-centric mindset [4]. Organizations with a strong digital culture are better equipped to adapt to changing environments, especially in times of crisis such as the COVID-19 pandemic [16, 17]. DOC is a dynamic and evolving concept that requires organizations to combine ideology and technology, advocating for core organizational concepts through global digital trends [16]. It is essential for organizations to develop a well-planned and well-defined strategy for digital transition to successfully accomplish this cultural transformation [18].

2.3. Sustainable performance

Sustainable performance (SP) is defined as the integration of environmental, social, and economic performance of an organization [19]. It encompasses the concept of achieving long-term goals while maintaining a balance between context, strategy, management processes, resources, and intangibles, it requires organizations to achieve a well-balanced equilibrium between context, strategy, management processes, resources, and intangibles to attain their sustainability goals

over an extended period [20]. SP in *MTCs* in Egypt is gaining importance as the country aims to achieve its sustainable development goals by 2030.

In the telecommunications sector, the implementation of environmental and social corporate governance practices has shown a strong correlation with financial performance. Companies listed on the Egyptian Stock Exchange (EGX 30) that adopt good ESG practices tend to demonstrate better financial outcomes [21]. This suggests that sustainability initiatives can positively impact both environmental and economic aspects of telecom companies in Egypt. Interestingly, SP in Egyptian *MTCs* is closely tied to the adoption of social practices, implementation of environmental initiatives, and strong corporate governance. As Egypt strives to achieve its sustainability goals, telecom companies have the opportunity to contribute significantly by integrating these practices into their operations and strategies.

2.4. Digital leadership and digital organizational culture

DL plays a crucial role in shaping and fostering a DOC, which is essential for successful digital transformation and organizational performance in the modern business landscape. Digital leaders are responsible for formulating a vision that integrates technology into business strategy, building a culture of innovation, developing employees' digital skills, and creating organizational flexibility [12]. This leadership approach directly and indirectly affects organizational performance, with digital culture and employees' digital capabilities mediating this relationship [22].

Interestingly, DL has been found to have a moderating impact on the effect of social loafing on job performance, potentially explained by Social Impact Theory, Upper Echelon Theory, and Strategic Action Area Theory [23]. Additionally, DL has been shown to positively influence exploratory innovation, with digital entrepreneurial orientation and DOC mediating this relationship [5]. Leaders demonstrate a commitment to digital innovation; it fosters an environment that encourages employees to adopt digital practices [24]. In contrast, a lack of clear DL often leads to resistance among employees, stifling innovation and resulting in an organizational culture that is stagnant [25]. Effective DL is instrumental in managing the

cultural shift required to navigate digital transformations successfully [26].

Moreover, the development of a DOC is critical for adapting to the digital era and requires specific characteristics such as fault tolerance, innovation, digital skills, and an agile mindset [15]. DL and corporate culture significantly influence digital competence development [27], and organizations can leverage digital culture and leadership to transform into digital organizations [28, 29]. By focusing on digital capabilities and DOC as fundamental predictors for digital innovation, businesses can flourish in the digital age [4, 29]. From another viewpoint, research indicates a reciprocal relationship between DL and organizational culture, where each influences the other. A strong digital culture, as facilitated by effective leadership, can enhance organizational performance by fostering innovation and responsiveness [30]. In their analysis, it was found that Egyptian *MTCs* with a well-established digital culture showed improved customer satisfaction and operational efficiency [31]. The ability to quickly adapt to technological changes and market demands is a hallmark of organizations that successfully integrate DL with a strong digital culture. By prioritizing digital literacy and innovation, these companies can maintain a competitive edge in a rapidly changing industry [32]. While specific data on Egyptian *MTCs* is limited in the provided context, the research suggests that DL is likely to have a significant influence on shaping DOC, the relationship between DL and DOC is instrumental in shaping the future of Egyptian *MTCs*. Therefore, the following hypothesis can be proposed:

Hypothesis 1. DL has a positive effect on DOC.

2.5. Digital organizational culture and Sustainable Performance

DOC plays a significant role in influencing SP across various industries. Research indicates that a strong DOC positively impacts SP through multiple mechanisms. Studies show that corporate affinity for technology, a key aspect of DOC, has a positive and significant impact on SP [33]. This relationship is mediated by team innovation performance, suggesting that a digital culture fosters innovation, which in turn enhances sustainability. Similarly, digital transformation and digital competencies significantly influence digital HR management, which positively

impacts organizational culture and promotes sustainable practices [34].

Interestingly, some contradictions exist in the literature. While most studies support the positive relationship between DOC and SP, one study found that DOC has no direct association with bank performance [35]. This highlights the need for further research to understand the nuances of this relationship across different sectors. Although various studies, the majority of evidence suggests that DOC is crucial for SP. It enhances environmental performance through green technological innovation and improved corporate governance [36]. Furthermore, DOC can enhance the effectiveness of other sustainability-related practices, such as CSR digitalization [37]. This suggests that *MTCs* in Egypt could benefit from fostering a digital culture to enhance their SP and building a tech-savvy workforce and promoting digital culture across their organizations to achieve better sustainable outcomes. Interestingly, while the direct relationship between DOC and SP in Egyptian *MTCs* is not explicitly addressed in the provided papers, related research offers valuable insights. Finally, while there is limited direct evidence specific to Egyptian *MTCs*, the available research strongly suggests that fostering a DOC can positively influence SP. Companies in this sector should consider investing in digital technologies, developing digital competencies, and promoting a digital culture to enhance their sustainability efforts and overall performance. Further research specifically focused on the Egyptian telecommunications sector would be beneficial to validate these findings and provide more targeted insights.

Hypothesis 2. DOC has a positive effect on SP.

2.6. Digital leadership and sustainable performance

The relationship between DL and SP is mediated by several factors. Artificial intelligence plays a crucial role in this relationship, with DL and AI together enhancing innovative talents and subsequently improving SP [38]. DL enhances innovation capabilities and productivity, leading to improved long-term organizational performance [39, 38]. Companies led by digitally savvy leaders experienced significant improvements in sustainability performance metrics, including reduced carbon emissions and improved waste management practices [40]. Digital culture and

employees' digital capabilities also partially mediate this relationship, highlighting the importance of fostering a digital-friendly environment and developing workforce skills [22]. Additionally, digital technology-business alignment serves as a mediator, with environmental uncertainty moderating this indirect effect [41]. Moreover, DL fosters innovation, which is crucial for developing sustainable practices. Digital leaders encourage a culture of experimentation and collaboration, wherein employees feel empowered to propose and experiment with innovative solutions [42]. This innovative culture is instrumental in generating new products, services, and processes that not only meet market demands but also adhere to sustainability principles.

Additionally, IT capabilities, particularly an IT-proactive stance, and organizational learning fully mediate the relationship between DL and sustainable organizational performance [43]. However, while the benefits of DL for SP are evident, challenges remain. Resistance to change, inadequate digital skills among employees, and the potential for digital divide issues can impede the full realization of DL's benefits [44]. Moreover, the ethical considerations surrounding data privacy and security also present significant hurdles that digital leaders must navigate to foster a genuinely sustainable and responsible digital transformation. In conclusion, DL is a critical factor in driving SP in the modern business landscape. It not only directly influences SP but also catalyzes the development of other crucial organizational capabilities such as AI integration, IT proficiency, and digital culture. As organizations continue to navigate the challenges of digital transformation and sustainability, cultivating strong DL will be essential for achieving long-term success and resilience in an increasingly technology-driven world [45, 46, 47]. Moreover, DL has been found to have a positive impact on sustainable competitive advantage and organizational performance. In a study of Indonesian *MTCs*, DL was shown to have a greater influence than innovation management in driving sustainable competitive advantage [2]. This suggests that digital leaders are essential in guiding companies through digital transformation and adapting to disruptive changes in the industry. Interestingly, the relationship between DL and SP is not always direct. A study on Indonesian *MTCs* revealed that DL impacts dynamic capabilities both directly and indirectly through market

orientation [1]. This highlights the importance of digital leaders focusing on market orientation to create optimal value in facing current and future business challenges.

Finally, while specific data on Egyptian *MTCs* is limited, the available research suggests that DL is likely to play a significant role in driving SP in this sector. As *MTCs* in Egypt strive to adapt to digital disruption and improve their SP, developing strong DL capabilities should be a priority. From this perspective, the following hypothesis can be formulated:

Hypothesis 3. DL has a positive effect on SP.

2.7. The mediating effect of digital organizational culture

DL has a significant positive impact on sustainable organizational performance, with DOC playing a crucial mediating role in this relationship [43, 38, 22]. The adoption of DL practices fosters a digital culture within organizations, which in turn enhances SP outcomes. Several studies have found that digital culture and employees' digital capabilities partially mediate the relationship between DL and sustainable organizational performance [33, 22]. This suggests that while DL directly influences performance, its effect is amplified through the cultivation of a digital-oriented organizational culture. Interestingly, some research indicates that organizational digital culture fully mediates the relationship between corporate affinity for technology and SP [33], highlighting the critical role of culture in translating technological capabilities into tangible performance outcomes. Finally, the mediating effect of DOC in the impact of DL on SP is well-supported by empirical evidence. Organizations seeking to enhance their SP through DL should prioritize the development of a strong digital culture [48, 5]. This culture acts as a catalyst, enabling the full potential of DL to be realized in terms of improved organizational sustainability and innovation [34]. This suggests

that DL impacts SP through multiple interconnected pathways within the organization. Overall, the research indicates that cultivating a strong DOC is a key mechanism through which digital leaders can drive long-term SP, but it should be viewed as part of a holistic approach that also develops other digital and innovative capabilities throughout the organization. the interplay of DL, DOC, and SP merits significant attention. DL acts as a catalyst for fostering a digital culture that aligns with and promotes sustainable practices. The mediating effect of DOC is pivotal; it not only facilitates the translation of DL into actionable performance metrics but also creates an environment where sustainable practices can flourish. Therefore, we propose the following hypothesis:

Hypothesis 4. DOC acts as a mediator between DL and SP.

2.8. Research gap

While there is an abundance of studies on the individual aspects of digital leadership, digital organizational culture, and sustainable performance, limited empirical research exists examining the interrelations between these three constructs. Most existing literature tends to treat them in isolation, failing to capture the dynamic pathways through which digital leadership influences sustainable performance via digital organizational culture.

2.9. Research framework

Based on the research objectives, literature review, and hypothesized relationships between variables, the analytical framework of this study is presented in Figure 1. In the research framework, DL is the independent variable, DOC is the mediating variable, and SP of Egyptian *MTCs* is the dependent variable. Previous research has examined the direct impact of DL on SP, but it has not discussed how this impact occurs or whether it occurs through other mediating variables.

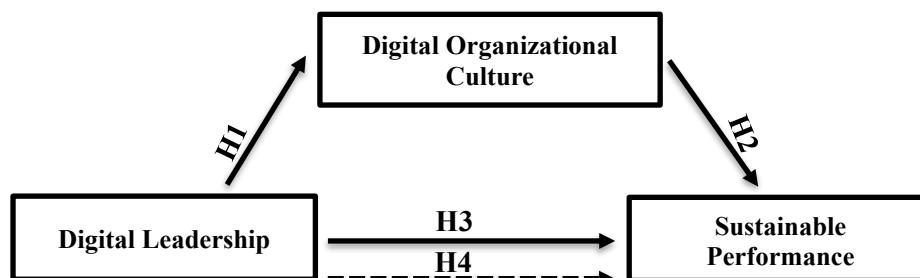


Fig.1. The Research Framework

Therefore, this study directly overcomes the need for an integrated framework of all DI, SP, and DOC. Furthermore, the DOC mediating contribution between DI and DOC adds fresh insights to the existing literature.

3. Methodology

The study used the descriptive analytical approach as one of the deductive approaches that depends on describing and analyzing the phenomenon under study in preparation for measuring it in the field of study, through collecting data, testing hypotheses, and addressing research questions related to the subject of the study, as qualitative and quantitative data were analyzed in an integrated manner that allows a comprehensive and deep understanding of the phenomenon under study, and contributes to reaching accurate results that can be interpreted and achieving the main objective of the research, which is exploring the mediating effect of digital organizational culture in the relationship between digital leadership and achieving sustainable performance of Egyptian telecommunications companies.

3.1. Measurement

The constructs were assessed and measured as reflective scales ranging from unidimensional to multidimensional, with each item rated on a five-point Likert scale ranging from 1 for

“strongly disagree” to 5 for “strongly agree.” DL was measured using six items adapted and used [49, 50, 22], while DOC was measured using four items adapted [29]. For the dependent variable, SP as a latent second-order construct was based on three first-order constructs. It was reflected by six-item economic performance, four-item social performance and three-item environmental performance, was used and developed [51].

3.2. Data collection and sample

The survey method was used as a tool for collecting primary data, as it was widely used in previous research that dealt with research variables. The questionnaire was distributed to a sample of employees working at various administrative levels within mobile telecommunications companies in Egypt, which numbered four companies: Vodafone, Orange, Etisalat, and WE. The number of valid responses for analysis reached 331 out of 388 responses collected, where 57 questionnaires were deleted due to straight-lining 22 cases, outliers 19 cases, and missing values 16 cases. A summary of the sample description is presented in Table 1. according to gender, age, education level, and years of experience.

4. Data Analysis and Results

In this study, the measurement model, research hypotheses, and structure model were analyzed using Smart PLS software V.4.

Tab.1. Sample description

Variable	Classification	Frequency	Percentage (%)
Gender	Male	208	63
	Female	123	37
	Total	331	100.0
Age	Under 20 Years	39	12
	Between 20 and 30 years	112	34
	Between 30 and 40 years	93	28
	Between 40 and 50 years	59	18
	Above 50 years	28	8
	Total	331	100.0
Educational Level	Intermediate qualification	33	10
	higher qualification	263	79
	Master	26	8
	Ph.D.	9	3
	Total	331	100.0
Years of experience	Less than 5 years	34	10
	From 5 to less than 10 years	115	35
	From 10 to less than 15 years	131	40
	15 years and more	51	15
	Total	331	100.0

As a non-causal prediction method, PLS-structural equation modeling (SEM) allows simultaneous analysis of multiple variables and the estimation of complex models and structural paths [52].

4.1. Evaluating the reflective measurement model

The reflective measurement model included a second-order factor for SP and was evaluated in terms of indicator consistency, internal consistency, reliability, convergent validity, and discriminant validity (Figure 2). Table 2 shows the criteria and ranges used to evaluate the reflective measurement model in this study [52]. Table 3 shows that all indicators loaded substantively, were statistically significant, and fell within an acceptable range of (0.725–0.908),

more than 0.708. The values of Cronbach’s alpha for all constructs were greater than 0.70 and ranged from 0.861 to 0.931. Additionally, composite reliability (CR) estimates were higher than 0.70 and ranged from 0.915 to 0.945. Thus, internal consistency reliability was achieved, and the average variance extracted (AVE) for all first-order constructs surpassed the threshold value of 0.50 and ranged from 0.671 to 0.783, thus meeting the necessary conditions for convergent validity.

Finally, Tables 4 and 5 show that the square root of the AVE for each construct exceeded its bivariate correlation with other constructs, and all heterotrait-monotrait (HTMT) criterion values were less than the cut-off value of 0.85, respectively, indicating that discriminant validity was achieved.

Tab.2. Evaluation criteria of the reflective measurement model

Evaluation	Criteria	Statistical Threshold
Indicator reliabilities	Reflective indicator loadings	≥ 0.708
Internal consistency reliability	Cronbach’s alpha	≥ 0.70
	Composite reliability (CR)	≥ 0.70
convergent validity	Average variance extracted (AVE)	≥ 0.50
Discriminant validity	Heterotrait-monotrait (HTMT) ratio	< 0.90 For conceptually similar constructs. < 0.85 For conceptually different constructs.
	Fornell–larcker criterion	The correlations of a construct with other constructs are less than the square root of its AVE.

Note: Adapted [52]

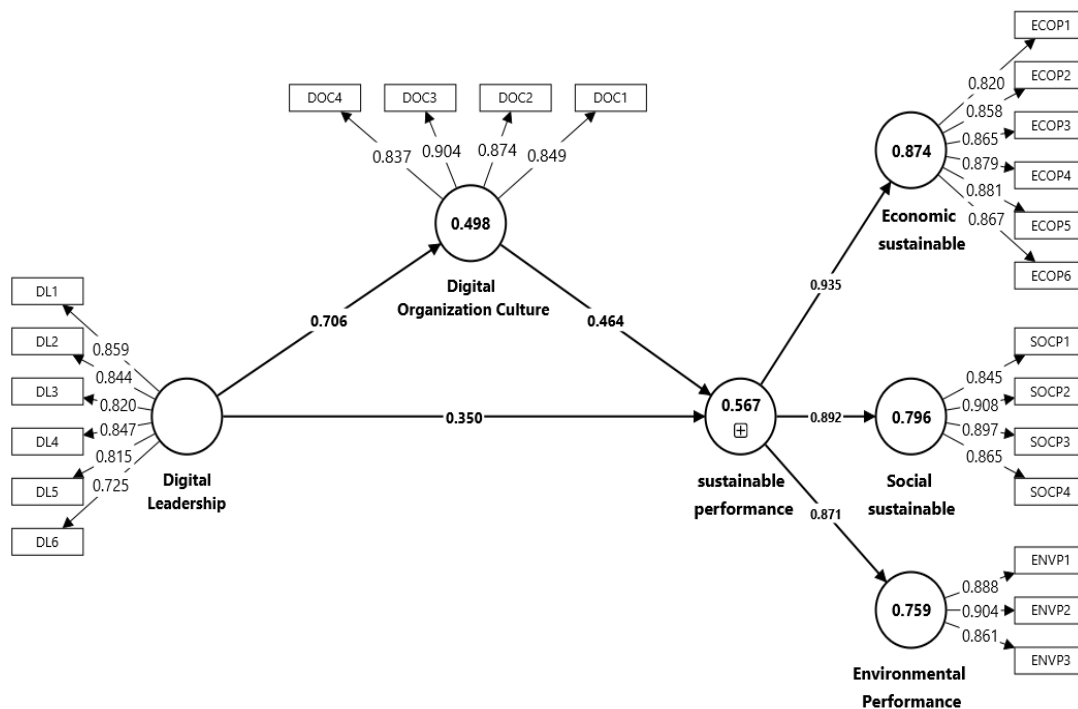


Fig.2. The reflective measurement model (First-order)

Tab.3. Measurement items of the first-order constructs

Construct and Items	Standardized Loading (sig.)	Alpha	CR	AVE
Digital Leadership		0.901	0.924	0.671
DL1: A digital leader raises the awareness of the employees of the institution about the risks of information technologies.	0.859**			
DL2: A digital leader raises awareness of the technologies that can be used to improve organizational processes.	0.844**			
DL3: A digital leader determines the ethical behaviors required for informatics practices together with all its stakeholders.	0.820**			
DL4: A digital leader plays an informative role to reduce resistance to innovations brought by information technologies.	0.847**			
DL5: A digital leader shares his/her own experiences about technological possibilities that help his colleagues to learn about the organization's structure.	0.815**			
DL6: In order to increase participation in the corporate vision, a digital leader guides the employees of the institution regarding the technological tools that can be used.	0.725**			
Digital Organizational Culture		0.889	0.923	0.751
DOC1: The teams collaborate functionally in the initiatives for the innovation and digital transformation.	0.849**			
DOC2: There is a clear orientation to digital technology changes inside the organization's culture.	0.874**			
DOC3: The culture of digital innovation and change takes part as a natural process within the organization.	0.904**			
DOC4: The organization shares with the staff the digital strategy, taking into consideration their suggestions.	0.837**			
Sustainable Performance				
Economic performance		0.931	0.945	0.743
ECOP1: The company's productivity has improved in recent years.	0.820**			
ECOP2: The company's labor turnover rate has improved in recent years.	0.858**			
ECOP3: The company's operating costs have decreased in recent years.	0.865**			
ECOP4: The company's business has grown in recent years.	0.879**			
ECOP5: The level of customer loyalty to the company has increased in recent years.	0.881**			
ECOP6: The level of customer satisfaction with the company has increased in recent years	0.867**			
Social performance		0.902	0.931	0.773
SOCP1: The company has successfully reduced waste across its processes.	0.845**			
SOCP2: The company has achieved resource efficiency across its processes.	0.908**			
SOCP3: The company has improved the compliance to environmental standards.	0.897**			
SOCP4: The company has improved work safety in recent years.	0.865**			
Environmental performance		0.861	0.915	0.783
ENVP1: The company has improved work environment in recent years.	0.888**			
ENVP2: The company has improved its relationship with the community and/or stakeholders in recent years.	0.904**			
ENVP3: The company has improved the quality of life of the surrounding community in recent years.	0.861**			
Note: **: P<0.01. Alpha denotes Cronbach's alpha; CR denotes composite reliability; and AVE is the average variance extracted.				

Tab.4. Descriptive statistics and correlations between constructs (Fornell-Larcker method)

NO.	Construct	1	2	3	4	5
1	Digital Leadership	0.819				
2	Digital Organizational Culture	0.706**	0.866			
3	Economic performance	0.610**	0.651**	0.862		
4	Social performance	0.652**	0.654**	0.720**	0.879	
5	Environmental performance	0.571**	0.618**	0.726**	0.726**	0.885
	Mean	3.513	3.447	3.491	3.253	3.379
	Standard Deviation	0.924	0.994	1.060	1.041	1.044

Notes: **: P< 001; The square root of AVE is typed in bold italic along the diagonal

Tab.5. Heterotrait-monotrait (HTMT) criterion values

NO.	Construct	1	2	3	4	5
1	Digital Leadership					
2	Digital Organizational Culture	0.787				
3	Economic performance	0.665	0.715			
4	Social performance	0.720	0.729	0.784		
5	Environmental performance	0.647	0.708	0.811	0.822	

The second-order constructs were included in the first analysis model (repeated indicators approach) but were not yet examined and evaluated. Therefore, the two-stage approach proposed was used to evaluate the constructs of the second-order reflective measurement model represented by SP (Figure 3) [53]. After the first-order evaluation, the latent variables were determined and used as manifest variables for the second-order constructs. Tables 6 and 7 show the validity and reliability results for these constructs. Table 6 shows the indicator factor loadings, the Cronbach's alpha values, which were 0.887, the CR values, which were

0.930, and AVE values that surpassed the threshold value of 0.50, indicating that internal consistency reliability and convergent validity were achieved. Further, Table 7 shows that all HTMT values were less than 0.85, thus establishing discriminant validity for the second-order constructs. These results indicate acceptable psychometric properties.

4.2. Evaluating the structural model

Through the coefficient of determination R² (explained variance), the effect size (f²), and the variance inflation factor (VIF), the structural model (Figure 4) was evaluated.

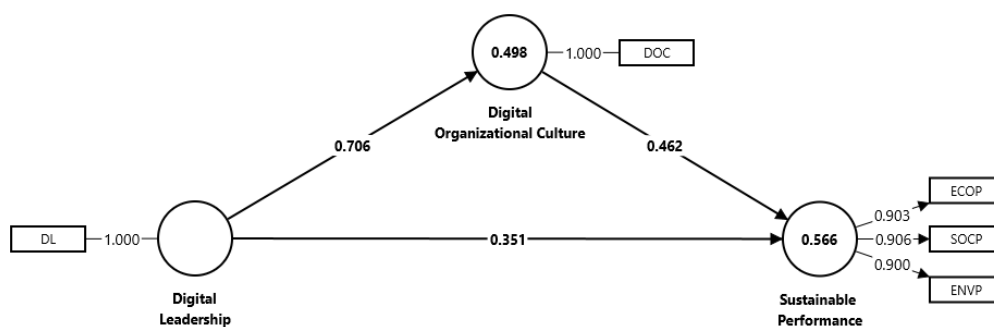


Fig.3. The reflective measurement model (Second-order)

Tab.6. Measurement items of the second-order constructs

Construct and Items	Standardized Loading (sig.)	Cronbach's Alpha	CR	AVE
Sustainable Performance		0.887	0.930	0.816
Economic performance	0.903			
Social performance	0.906			
Environmental performance	0.900			

Note: **: P<0.01. Alpha denotes Cronbach's alpha; CR denotes composite reliability; and AVE is the average variance extracted.

Tab.7. Heterotrait-monotrait (HTMT) criterion values (second-order)

NO.	Construct	1	2	3
1	Digital Leadership			
2	Digital Organizational Culture	0.706		
3	Sustainable Performance	0.718	0.753	

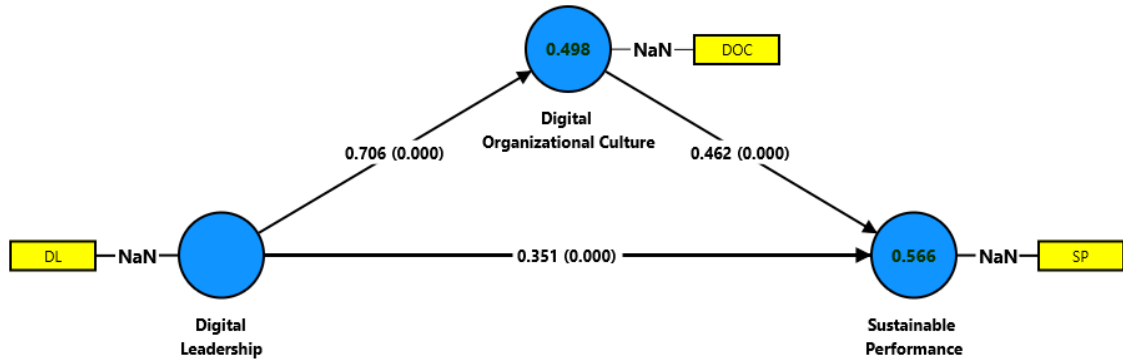


Fig.4. The structural model

First, the criterion for evaluating the structural model was the coefficient of determination (R^2) of the endogenous latent variables. Accordingly, these coefficients were measured. Our results show that $R^2 = 0.498$ for DOC and $R^2 = 0.566$ for SP (Table 8). This means that 49.8% of DOC and more than 55% of SP were explained by the independent variables in our conceptual models. Second, the effect size (f^2) measures the power of each variable in explaining endogenous variables. The results indicate that the effect size of the constructs recorded values of 0.143, 0.247, and 0.994, and ranged between weak, medium and strong [54]. Third, all VIF values were below the conservative threshold of 3 and our structural model had no critical issue of collinearity among the predictor constructs [55].

4.3. Hypotheses tests

The “direct effect” hypotheses were tested first by examining the standardized path (beta) coefficients and associated significance levels. Bootstrapping procedures with 5,000 resamples were used to evaluate the significance of the path coefficients. As shown in Table 9, the results supported the proposition that DL Has a direct positive and significant impact on DOC (H1: $\beta = 0.706$, $p < 0.01$, confidence interval (CI)= 0.641 to 0.762), thus verifying H1. Next, DOC was found to have a positive and significant impact on SP (H2: $\beta = 0.462$, $p < 0.01$, confidence interval (CI)= 0.609 to 0.740), supporting H2. Moreover, DL was found to have a direct positive influence on SP (H3: $\beta = 0.351$, $p < 0.01$, confidence interval (CI)= 0.574 to 0.247), thereby supporting H3.

Tab.8. Structural model evaluation

Construct	Variance Inflation Factor (VIF) Collinearity Assessment	Confidence Intervals 95% (BCa) Bootstrap		F ² Effect Size	Level of R ²
		2.5%	97%		
Digital Leadership	1.000	0.641	0.762	0.994	
Digital Organizational Culture	1.994	0.609	0.740	0.143	0.498
Sustainable Performance	1.994	0.332	0.574	0.247	0.566

Tab.9. Structural model estimates

Hypothesis	β	Critical ratio	P-Value	Results
H1 Digital leadership → Digital Organizational Culture	0.706	22.93	<0.01	Supported
H2 Digital Organizational Culture → Sustainable Performance	0.462	7.457	<0.01	Supported
H3 Digital leadership → Sustainable Performance	0.351	5.987	<0.01	Supported
H4 Digital leaders → Digital Organizational Culture → Sustainable Performance	0.326	7.663	<0.01	Supported

The mediating role of DOC hypothesized in H4 was tested using the bias-corrected (BCa) bootstrap method with 95% confidence intervals (CIS) [56]. Bootstrapping analysis revealed that the standardized coefficient (β) for the indirect effect of DL on SP through DOC was significant ($\beta = 0.326$, CI = 0.238 to 0.405; $p = 0.001$), indicating partial mediation due to the significance of the direct effect in H3. Thus, these results partially support H4. A summary of these results is presented in Table 9.

5. Discussion

This study examines the direct and indirect effects of DL on the SP of Egyptian *MTCs* and the mediating role of DOC. The results support H1, indicating that DL has a significant positive impact on DOC. The result shows that DL plays a crucial role in shaping and promoting a digital culture within organizations, which in turn contributes to improved performance and innovation. This result is in line with who stated that digital leaders are instrumental in fostering a DOC by formulating a vision that integrates technology into business strategy, building a culture of innovation, and developing employees' digital skills [12].

This aligns with the findings that DL positively influences digital entrepreneurial orientation and DOC, which mediate the relationship between DL and exploratory innovation [5]. As organizations navigate the complexities of digital transformation, the presence of dynamic leaders who can drive cultural change becomes increasingly vital. By leveraging digital tools and fostering an environment of inclusivity and innovation, digital leaders pave the way for organizations to thrive in this digital age. As such, organizations would be prudent to invest in developing robust DL capabilities to foster a culture that embraces and accelerates digital transformation.

Likewise, the results support H2, indicating that DOC has a significant positive impact on SP, which indicates that suggests that organizations with strong cultural values have a keen interest in sustainability and environmental concerns. These results are also in line with those arguing that corporations' digital technologies significantly elevate firms' SPs [33]. Our findings are in line with those who find that the managers with the cognition of sustainable opportunities are more

likely to transit digital capability and digital innovation orientation to digital sustainable entrepreneurship of social and environmental value creation [36]. Moreover, our findings are in line with those argued that the interplay between DOC and SP is crucial for SMEs aiming to enhance their CSR initiatives and achieve sustainable competitive advantages in today's digital landscape [37]. This underscores the importance of cultivating a culture that aligns with sustainability goals to achieve long-term organizational success across economic, social, and environmental dimensions. The integration of DOC within Egyptian *MTCs* is not merely a trend, but a strategic necessity that can significantly enhance SP.

Furthermore, the results support H3, which indicates that DL positively influences various aspects of sustainability, including environmental, social, and economic dimensions. These results are also in line with who stated that DL capabilities strengthen the relationship between innovative business models and SP, highlighting the synergistic effect of digital competencies and strategic digitalization in promoting sustainable practices [45]. However, our findings are in lined with those argued that as organizations continue to navigate the digital transformation era, developing strong DL capabilities becomes increasingly important for achieving long-term sustainability and success [39]. Therefore, if Egyptian telecommunications firms are to thrive in an increasingly competitive and environmentally conscious market, they must embrace DL not only as a strategic imperative but as a pathway to sustainable growth.

Finally, the results support H4, indicating that DOC plays a significant mediating role between DL and SP; this culture serves as a conduit for translating leadership efforts and technological investments into improved SP, making it a critical factor in the digital transformation of organizations. These results are also in line with those that state that the impact of DL on SP is multifaceted. It directly enhances organizational performance and indirectly influences it through mediating factors such as digital culture and employees' digital capabilities [22]. These results are also in line with those that state that the integration of DOC and SP is significant as it enhances adaptability, improves decision-making, fosters innovation, aligns practices with sustainability goals,

provides competitive advantages, and ensures long-term viability for SMEs [34].

The evidence strongly supports the mediating role of DOC in the relationship between DL and SP. Organizations aiming to enhance their sustainability through DL should focus on cultivating a strong digital.

6. Conclusion

The role of DL is paramount to the SP of MTCs. By fostering innovation, agility, empowerment, and data-driven decision-making, digital leaders lay the groundwork for success in a competitive market. Moreover, the mediating effect of DOC amplifies these contributions, ensuring that the workforce is aligned, engaged, and ready to embrace the digital transformation journey. As the telecommunications landscape continues to evolve, organizations that prioritize effective DL and nurture a strong digital culture will be best positioned for sustainable success in the digital age.

6.1. Theoretical and managerial implications

The mediating role of DOC on the relationship between DL and SP has not been widely studied in the context of the telecommunications sector. This essay explores the theoretical and managerial implications of DL's positive effect on the DOC of Egyptian *MTCs* as a first step. In Egypt's telecommunications sector, the interplay between DL and organizational culture is particularly significant. DL plays a crucial role in shaping and fostering a DOC, which is essential for successful digital transformation and sustainable organizational performance in the modern business landscape. DL and DOC are interconnected and mutually reinforcing elements that drive organizational success in the digital era. By fostering a digital culture, leaders can enhance digital capabilities, promote innovation, and improve organizational performance [22, 29].

DL has been shown to have a significant positive impact on SP. This suggests the importance of DL emerges as a critical factor in driving SP in the digital age. It enhances various organizational aspects like knowledge sharing, innovation, and learning capabilities, which collectively contribute to improved SP. As organizations continue to navigate digital transformation, cultivating strong DL will be essential for achieving long-term sustainability and success [45, 39]. However,

DOC has been found to have a significant positive impact on SP and the majority of studies support the positive effect of organizational culture on SP. Organizations with strong cultures that prioritize sustainability and environmental concerns tend to achieve better sustainable outcomes [33]. A strong organizational culture that emphasizes adaptability, innovation, and social responsibility is essential for achieving SP in an industry marked by rapid change and intense competition. DOC plays a significant mediating role between DL and SP. By cultivating a strong digital culture, organizations can amplify the positive effects of DL on their long-term success and adaptability in the rapidly evolving digital landscape.

6.2. Practical implications

Our findings offer valuable insights to realize the practical implications of DL and organizational culture on SP, Egyptian *MTCs* must take decisive actions. This includes investing in leadership development programs that emphasize digital literacy and cultural awareness, promoting cross-functional collaboration, and establishing frameworks that encourage innovation. By nurturing an ecosystem that values DL and fostering a supportive organizational culture. Moreover, to build DOC, Egyptian telecom leaders should prioritize investments in technology, develop a tech-savvy workforce, and promote digital culture across the organization. They should also focus on dimensions like innovativeness, teamwork, training and development, and empowerment to enhance employee commitment. By balancing technological adoption with cultural transformation, digital leaders can effectively guide their organizations through the digital transformation journey. Thus, Egyptian *MTCs* cannot only enhance their current performance but also secure long-term sustainability in a rapidly changing digital landscape. The journey towards SP in Egypt's telecommunications sector hinges on the integration of effective DL with a resilient organizational culture. As companies embrace these principles, they will be better equipped to thrive in an era marked by rapid technological progression and evolving consumer expectations.

6.3. Limitations and future research directions

This study explores the limitations of existing research on the role of DL in fostering SP

within Egyptian telecommunications companies, specifically examining the mediating effect of DOC. Furthermore, it proposes future research directions to address these limitations and enhance the understanding of this critical relationship. Much of the existing literature on DL and SP is derived from studies conducted in Western contexts or globally recognized telecommunications markets. This poses a significant limitation, as cultural, economic, and regulatory dynamics in Egypt may differ markedly from those in other regions. Egyptian *MTCs* operate within a unique socio-economic environment characterized by specific challenges such as economic fluctuations, regulatory constraints, and varying consumer behavior, which have not been adequately addressed in the literature.

Future research should focus on developing a tailored framework that addresses the unique characteristics of the Egyptian telecommunications market. This framework should take into account local cultural norms, market dynamics, and regulatory conditions to provide a more accurate analysis of the interplay between DL, organizational culture, and SP. Moreover, future research should delve deeper into specific facets of DOC, such as adaptability, employee engagement, and innovation. Investigating how these elements mediate the relationship between DL and performance can generate actionable insights for companies aiming to enhance their sustainability efforts.

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