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THE IMPACT OF TRANSFORMATIONAL LEADERSHIP AND DIGITAL LITERACY ON INNOVATION CAPABILITY: MEDIATING ROLE OF ORGANIZATIONAL CULTURE FOR INNOVATION

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KEYWORDS	ABSTRACT
Transformational Leadership, Digital Literacy, Innovation Capability, Organizational Culture for Innovation	<p>The purpose of this research is to investigate the effects of transformational leadership & digital literacy of leaders on innovation capacity of organization while considering mediating effect of organizational culture for innovation. The data were collected from the sample of manufacturing SME's leaders and employees using a structural equation modeling (SEM) technique. The study finds that transformational leadership & digital literacy positively influence the innovation capability. Nevertheless, organizational culture for innovation was determined to mediate this relationship and to enhance diverse effects of transformational leadership & digital literacy on innovation outcomes. These observations focus the need for refining organizational culture that supports creativity and innovation, and enhancing leadership skills and digital literacy of leaders for organizational innovation. This study adds to existing literature on leadership, digital literacy, organizational culture & innovation capability, providing guidance for managers and policymakers about the research issues so as to enhance innovation efforts within their organizations toward desired success.</p>
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INTRODUCTION

In the modern world characterized by intensified and ever-changing business environment, the organizational competition has become a major challenge, and so is the necessity to evolve persistently (Asif, Yang & Hashim, 2024). This capability refers to the ability of an organization to develop new generations of product offering and improve existing ones, and this is a critical factor in this case (Bagga, Gera & Haque, 2023). Still, innovation management is a relatively

narrow problem which requires leadership, qualified staff, and proper organizational culture (Mahendra, Muttaqijn & Hadiwijaya, 2024). The objective of research study will be to compare the impact of self-leadership and technological competence of leaders on degree of innovation in organization by considering organizational culture that affects innovation. Transformational leadership is described as leaders who lead their followers to attain superior performance by appealing their self-interest and by providing direction for change. Such leaders are dreaming big and focus on the importance of team's diverse backgrounds and the need to spur creativity among members (Alabdali, Yaqub, Agarwal, Alofaysan & Mohapatra, 2024; Chong & Zainal, 2024).

On the other hand, and arguably less expansive, digital literacies pertain to leaders' ability to understand, engage with & exploit technology. In today's world where everything is switching to the digital environment, leaders who are high on digital quotient are well placed to leverage the technology, try to look at the possibilities of redesigning solutions that are innovative and which can help in enhancing the efficiency and effectiveness of their organizations (Ghrbeia & Alzubi, 2024). The variable that aids in making the relationship between leadership and digital literacy about innovation capability more explicable is organizational culture for innovation. Organizational culture entails the system of belief that is held by members of an organization as result of congregation within a given community (Abbas, Latif & Sarwar, 2024). Innovation culture entails organizations adopting change, inspiring individuals to take risks, and valuing creativity besides offering an environment within which new concepts can be tried out as well as implemented. To do this, it is imperative that the findings regarding leadership practices & digital literacy articulate culture for understanding how innovation is sparked in organizations (Zhang, Liu, Wei, Cao & Gui, 2023). However, role and significance of these factors has been established and there is still remnant lack of literature on both theoretical as well as practical literature.

Conceivably, it is pertinent to integrate two notions of transformational leadership and digital literacy within the conceptual framework of innovation capability. While both variables have been analyzed in prior literature individually (Malik, Raziq, Sarwar & Tariq, 2024), analyzing their combinations and the influence of mediating variables such as, organizational culture is less explored. In practice, organizations are frequently unable to determine specific leadership characteristics and digital literacy that may promote innovative culture. IFC could fill these gaps thus help in enriching knowledge within the literature on how innovation capability can be enhanced in many organisations (Khin & Ho, 2019). The research question of present study pertains to examining how exactly transformational leadership behaviour and digital literacy of leaders influences the innovation capacity of the organisations, with the mediating role of organisational culture that to what extent culture matters in linking leadership and innovation. This is the crucial relationship to encourage organisations that are aiming to construct strategic intervention aiming at enhancing their innovation capabilities. As the leadership and skill at working with technologies are vital in the modern business setting, this research shall provide real-life solutions for the leadership development and organizational culture modification for organizations.

The primary objectives of this study are threefold: First, to validate hypotheses 1 to 3, the direct relationship amid independent variable of transformational leadership & dependent variable of innovation capability, where H1 states that there will be a positive direct relationship amid transformational leadership and innovation capability. Second, to investigate the correlation between second research variable, whereby, the level of digital literacy of leaders and fourth research hypothesis, which is innovation capability of the organisation. Third, to investigate the moderation role of organizational culture towards innovation within the framework of the mediators: the digital literacy and innovation capability regarding the independent variable of transformational leadership. Overall, this study aims at making the research contribution to existing literature on leadership and innovation, along with providing actionable insights for organisation looking to enhance innovation outcomes. Consequently, explaining the impact of transformational leadership, digital literacy on innovation capability and underlining the role of organizational culture, study offers theoretical guidelines for designing leadership training & cultural interventions. Also, it offers tool for organizations to evaluate & enhance innovation management, enhancing their performance in face of increased rivalry and dynamism in the market.

LITERATURE REVIEW

Transformational Leadership & Innovation Capacity

The transformational leadership is known for its effectiveness in promoting innovation within organizations. These are those who lead their subordinates to go beyond their self-interests in order to achieve organizational objectives and foster environment of innovation (Gui, Lei & Le, 2024). The leaders exhibit behaviors that are revolutionary, creative, and innovative, which are key elements of innovation. The following are some of approaches that these leaders use such as-championing an inspiring vision, generating awareness in employees & meeting individual needs of the employees (Antonio, Pérez, Molina, Baier & Yenny, 2024). This leadership style is mainly relevant in today's society where business organization are facing so much competition in various environments which need creativity. The studies conducted have provided evidence in support of the proposed link between transformational leadership and enhanced innovation capacity. For instance, Karimi, Malek, Farani & Liobikienė (2023) found that transformational leadership actions help to develop organizational innovation by promoting knowledge sharing and teamwork. Similarly, Aldhaferi and Ahmad (2024) have established that transformational leaders in particular ignite innovation among employees by encouraging creativity and change at the workplace. In this linking, the findings of the study will provides an affirmation towards role played by transformational leadership in the development of organizational culture in the generation of innovations.

Leaders' Digital Literacy & Organizational Innovation

In the contemporary world, characteristics of leaders in relation to digital skills has significant influence on organizational innovation. The digital competency can be defined as knowledge and skills that enable an individual and an organization to engage, make use, and manipulate digital tools for the achievement of organizational objectives (Muslim & Setyono, 2024). Higher

levels of DL help a person, and an organization, to be prepared to embrace new technologies, handle change and build a culture of innovativeness (Schiuma, Santarsiero, Carlucci & Jarrar, 2024). Leadership digital literacy enables leaders to take the right decision on environment and win chances that comes from technology (Baroudi & Lytras, 2024). His mastery makes him in a place to ensure that digital means are well applied hence enhancing organizational efficiency and innovation. Different researches have shown that the level of e-readiness of leaders in an organization determines ability of that organization to innovate. Digital literacy, as suggested by Baroudi and Lytras (2024), entails supporting new forms of technologies leading to massive novelty in products, service deliveries and models. Malik et al. (2024) found that knowledge of technological skill of leaders enhances abilities in managing change and reducing resistance to it and strengthening of improvement and innovation culture. Their results endorse the idea that digital literacy is one of core elements of leadership that is significant in present business world for change.

Organizational Culture for Innovation as a Mediator

Organizational culture for innovation is therefore defined as the set of values in organization that support the generation of innovations. In this regard, this culture has a significant role to play in mediating the link amid leadership styles, leadership competencies, and innovation performance in the firm (Suyadi et al., 2024). It is vital to foster an organizational culture that supports the access to information and people, promotes teamwork and flexibility to translate ideas into actionable reality (Hussain et al., 2022). Organizational culture of innovation, which involves generating new ideas and products, can be developed by transformational leaders who are innovative and promote the culture. Transformational leadership is a leadership style where leaders inspire and motivate employees to exceed their own interests for the sake of the organization as effective leaders foster a culture that supports innovation, thereby enhancing innovation capability. For instance, they endorse the exchange of information, encourage the group problem solving as well as being instrumental in acknowledging the value and role of fresh ideas, which are invaluable in enhancing the innovation competences of an organisation (Salvador et al., 2022).

The mediating role of organizational culture for innovation is a research topic that has featured in many empirical works. Osman et al. (2023) suggested that while leadership has positive and direct relationship with innovation, an innovation friendly culture has a mediating effect on the leadership innovation relationship by creating environment that can foster generation and implementation of innovation. The organizational culture for the innovation is a set of shared values, beliefs, and practices that encourage and support innovation within an organization. This culture not only encourages the employees for innovative activities by creating high levels of motivation but also provides resources and structure for same. Moreover, strong innovation culture can reduce the risks of innovation, as it generates that kind of culture where it is not a shame to fail. Thus, several recommendations were made that forward culture of innovation must converge from the leadership efforts in order to bring them into reality (Jankelová, 2024). Thus, the mediating role of organizational culture for innovation suggests that the impact of

transformational leadership & digital literacy on innovation capability is influenced by culture of the organization.

RESEARCH METHODOLOGY

This research employs quantitative research approach that is rooted in positivism paradigm that deals with the observable and real phenomena. This is in line with the study's objective of examining the relationship between transformational leadership, leadership digital literacy, innovation capacity, and innovation culture. The target population consisted of the leaders and employees who work in manufacturing SMEs, and the sample consisted of 350 participants to ensure that the sample size is large enough and has statistical significance. The importance of this study is that it can help to close the gap between theory and practice in area of innovation management. The data was collected through a survey questionnaire as it is a fast and efficient method of data collection from a large number of participants. Therefore, the questionnaire was designed to measure the following constructs; likewise transformational leadership, digital literacy, innovation capability, and organizational culture for innovation using validated items from the literature.

The survey will be conducted online to ensure that as many people as possible can be reached and to get their responses within a short time. The method of analysis to be employed in this study is partial least squares structural equation modeling (PLS-SEM). This method is specially suitable for study since it can accommodate multiple relationships and it is not very sensitive to normality of data. The findings of this study will enable the understanding of the mediating role of organizational culture in the relationship between transformational leadership, digital literacy of leaders & innovation capability through use of the PLS-SEM. This approach ensures that the research is conducted in a very comprehensive and systematic manner to establish the relationship amid transformational leadership and digital literacy and innovation capability of an organization that has an innovative culture. The quantitative approach and the positivist philosophy used in the study make the findings of the study more accurate and valid; study adds value to the existing body of knowledge upon leadership, digital literacy, along with the innovation in organizations.

DATA ANALYSIS

Measurement Model

Table 1 offers a comprehensive account of the reliability assessment made. Cronbach's Alpha is used to determine internal consistency of the constructs which is a measure of reliability. In the table, the values indicate the level of internal reliability of each construct. Specifically, the construct of Digital Literacy of Leaders has the reasonable level of internal consistency with the Cronbach's Alpha coefficient of 0.8593, its RHO_A of 0.8897, and its Composite Reliability of 0.8891. This means that leaders are very well educated on use of digital technologies. Alike, other constructs such as Innovation Capability, Organizational Culture, and Transformational Leadership also have good levels of reliability, but slightly lower than that of Digital Literacy of Leaders. The average variance extracted (AVE) values also provide support for the validity

of the constructs as all are above the recommended threshold of 0.5. This means that a large amount of the variation in the observed variables can be explained by the constructs. In sum, the results from this reliability analysis support the adequacy and coherence of measurement model used to examine the different aspects of leadership and organizational processes in the particular context.

Table 1
Reliability Analysis

	CA	RHO_A	CR	AVE
Digital Literacy of Leaders	0.8593	0.8897	0.8891	0.5437
Innovation Capability	0.7172	0.7273	0.8025	0.5085
Organizational Culture	0.7179	0.7265	0.7983	0.5335
Transformational Leadership	0.786	0.7915	0.8533	0.5386

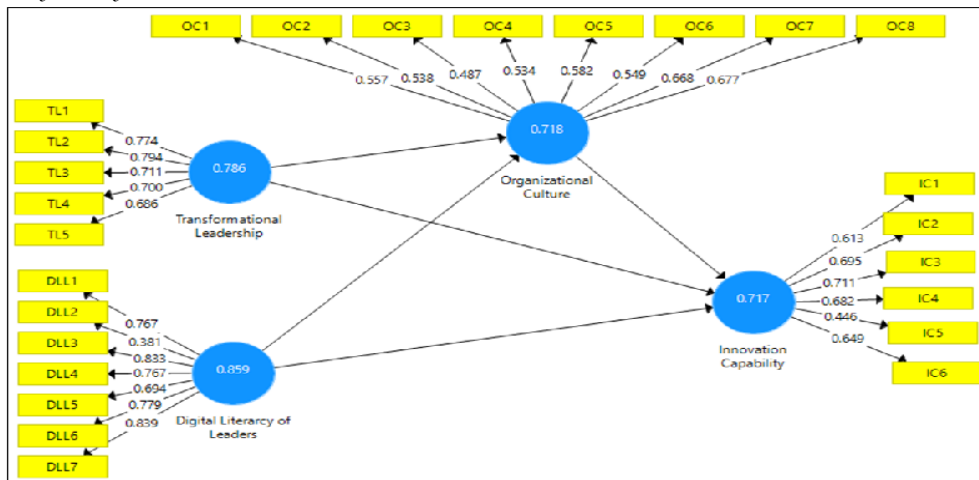
Table 2 focuses on validity assessment, especially through Heterotrait-Monotrait (HTMT) ratio, which tests for discriminant validity by comparing correlation of diverse construct. The values in this table are the ratios between correlations of constructs. A closer to zero value represents higher level of discriminant validity, meaning that constructs are different from each other. Examining the diagonal elements of table, all values are zero, and this is as expected because these values represent the correlations between construct and itself, which is a sign of perfect discriminant validity. Going away from diagonal, ratios are not equal. For instance, in digital literacy of leaders and innovation capability, ratio is 0.5638 that offers important information for current study.

Table 2
Validity Analysis (HTMT)

	[1]	[2]	[3]	[4]
Digital Literacy of Leaders [1]	0	0	0	0
Innovation Capability [1]	0.5638	0	0	0
Organizational Culture [3]	0.4828	0.5244	0	0
Transformational Leadership [4]	0.2981	0.4673	0.3456	0

This means that the relationship between these two construct is stronger than relationship they have with themselves, although it does not reach a level that would suggest that there is no discriminant validity. Likewise, in case of Organizational Culture and Innovation Capability, the ratio is 0.5244, which indicates that there is a moderate level of relationship between these two constructs. However, it is important to acknowledge that these ratios are not overly high, which means that although there may be some overlap between these constructs, they are still quite distinct from one another that determines capability for internal consistency. In general, this analysis of validity helps to understand the interconnections between various constructs used to measure the research issues from different perspectives and dimensions and identifies some overlapping or similar concepts and items that can be used in the research objectives as well as hypotheses.

Figure 1
Reliability Analysis



Structural Equational Model

Table 3 provides the direct effects of SEM whereby only the relationships between the various constructs in the model are of interest. These direct effects represent the effect of one construct on another and thus help to understand the links between the variables in question. For each direct effect, the table contains the information on the original sample (O), the sample mean (M), standard deviation (STDEV), T statistics. From the direct effects, it can be seen that Digital Literacy of Leaders has a positive effect on Innovation Capability (0.4012) and Organizational Culture (0.3632) with very low p-values (0). This supports the hypothesis that increased digital literacy among the leaders is associated with the higher innovation capacity and better suitable organizational culture.

The organizational culture has a positive and statistically significant impact on the Innovation Capability (0.2034), which supports the idea that positive organizational culture enhances the innovation within an organization. Furthermore, Transformational Leadership has a positive and strong effect on both Innovation Capability (0.2059) and Organizational Culture (0.1712), underlining the significance of the transformational leadership in fostering the innovation and organizational culture. In sum, these findings highlight the relationships between the different constructs in the structural model for study, and how digital literacy, organizational culture, and transformational leadership can positively impact on the innovation capability within the Concerned organization.

Table 3
Direct Effect

	OS	SM	STDEV	TS	PV
Digital Literacy of Leaders -> Innovation Capability	0.4012	0.3963	0.0311	12.8872	0

Digital Literacy of Leaders -> Organizational Culture	0.3632	0.3695	0.0362	10.0392	0
Organizational Culture -> Innovation Capability	0.2034	0.2066	0.0321	6.3321	0
Transformational Leadership -> Innovation Capability	0.2059	0.2114	0.0402	5.1211	0
Transformational Leadership -> Organizational Culture	0.1712	0.1714	0.0411	4.1649	0

The table 4 displays results of mediation analysis, with the indirect effects of digital literacy of leaders and transformational leader on innovation capability over mediation of organizational culture. In first pathway, digital literacy of Leaders has positive indirect impact on innovation capability over organizational culture (0.0739). This means that the effect of digital literacy of leaders on innovation capability is partially mediated over organizational culture. The p-value of 0 shows that there is significant evidence for mediated affiliation. In second pathway over leadership, there is also an indirect effect on innovation capability over culture (0. 0348). Even though effect size is less compared to first pathway, it still suggests a moderate indirect effect. P-value of 0.002 submits statistical significance while it is slightly higher than in first pathway. These results suggest that digital literacy of leaders and transformational leadership positively affect innovation capability directly and indirectly through organizational culture. Therefore, this underlines the significance of developing the positive culture in an organization as way of promoting innovation within an organization, with leadership characteristics having key role in defining culture.

Figure 2
Structural Equational Model

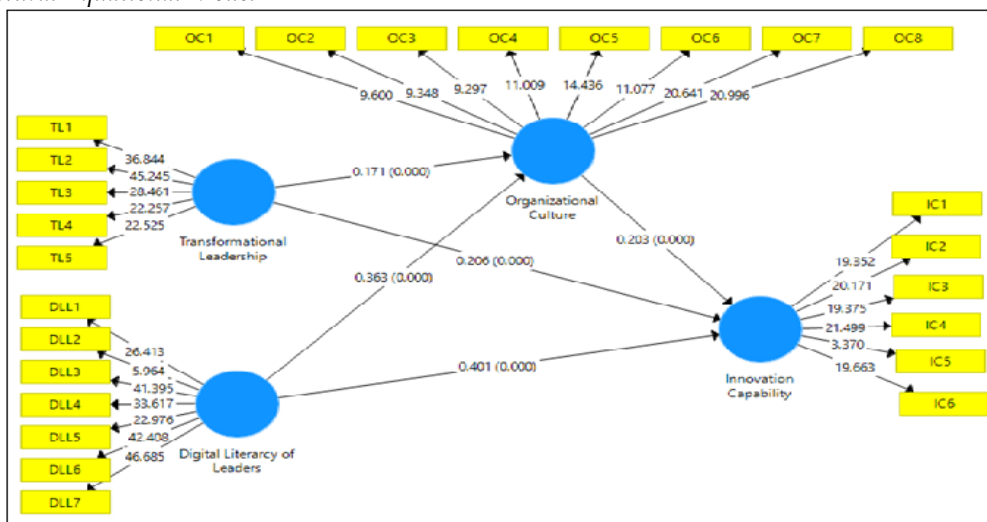


Table 4
Mediation Analysis

	OS	SM	ST	TS	PV
Digital Literacy of Leaders -> Organizational Culture -> Innovation Capability	0.073	0.076	0.014	5.048	0
	9	5	6	4	

Transformational Leadership -> Organizational Culture -> Innovation Capability	0.034	0.035	0.011	3.101	0.00
	8	7	2	4	2

DISCUSSION

These findings are useful in providing insights into relationship between leadership, culture and innovation as factors that define success of organizations in the current society. Firstly, the direct positive relationship between level of digital literacy of leaders and level of innovation capability indicates the importance of leadership in use of technology for innovation. The firms with executives who are digitally literate are in a position to seize opportunities that emanate from digitization, manage digital change and co-create value. This is in line with other research that has highlighted role of digital leadership in promoting innovation and competitiveness in digital society (Karimi et al., 2023; Khin & Ho, 2019; Shuaib & He, 2023). Also, positive direct relationship between the digital literacy of leaders and organizational culture lends credence to the argument that leadership behavior significantly influences culture in organizations. These are leaders that not only comprehend technology but comprehend how to inspire innovation and learning culture.

These leaders inspire the adoption of technology to foster collaboration, sharing of information and work flexibility to increase innovation at workplace. Likewise, positive direct relationship between transformational leadership and innovation capability suggests part that leadership plays in motivating employees to be innovative. Transformational leaders define the change, obtain pledge, and mobilize resources for change process. They are also capable of influencing the people and motivating them to think and act in a more innovative way, to experiment and innovate in order to transform the organization (Malik et al., 2024; Muslim & Setyono, 2024; Saeed et al., 2023). The mediation analysis provides a more nuanced view of how leadership behaviors affect innovation outcomes. Therefore, the study has established that organizational culture has a partial mediating effect on relationship amid digital literacy and transformational leadership and innovation capability, highlighting the importance of culture as an enabler of the required innovation.

Organizational culture that promotes trust, collaboration, and risk-taking will foster creativity from the employees and yield useful innovation. Thus, findings of this research suggest that leadership, culture, and innovation are related in organizations. Thus, by understanding the role of digital literacy, transformational leadership, and organizational culture in innovation, organizations can identify the potential approaches to promote innovation culture, equip their leaders with the necessary digital competencies, and analyze relationship between leadership behavior, organization culture & innovation outcomes. Investment in leadership development programs that foster the transformational leadership qualities. The high digital literacy enables employees to better utilize the digital tools and resources, fostering an innovative culture and improving innovation capability. Thus, they can cope with the problems of the information era, contribute to the formation of the sustainable development goals, and become successful in the modern world (Mahendra et al., 2024; Mohammed & AL-Abrow, 2023; Salvador et al., 2022; Schiuma et al., 2024).

CONCLUSION

In conclusion, therefore, findings of this research support the hypothesis that digital literacy, leadership styles, organizational culture & innovation capability are consistent in organization. The study shows that the leadership has a critical role in managing the new age and creating conditions for change. It is hypothesized that there is a direct relationship between leaders' digital literacy and transformational leadership behaviours and innovation capability while organisational culture serves as moderator. The implications of these findings are noteworthy for theory and practice because they offer organizations direction on how to cope with the challenges of digital era and thrive in the global environment. In the future, leadership, culture, and innovation should be viewed as interrelated and efforts should be made to harness this notable relationships.

By offering leadership development programs that focus on digital aptitudes, leaders should be equipped with the requisite digital competencies and transformational leadership skills to facilitate change and direct people towards positive change. In addition, there is need to foster idea generation, communication, and synergy within the context of organization to unlock the creativity of the workers. Based on conclusion of this study, authors recommend organisation leaders to adopt leadership, culture and strategy as three legacies of innovation. Hence, over leadership behavior, organizational culture, and innovation strategies, organizations should be able to capitalize on opportunities within market and effectively compete in the current digital business environment. Thus, organisations should embrace digital transformation, encourage the transformational leadership, and culture innovation to enable organisations to thrive in the digital environment.

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