Determining the Antecedents of Digital Leadership: The Nexus of Skill, Role, and Style

Andreas Wijaya[1]

Abstract:

Purpose: *Digital leadership has become prominent in bridging digital transformation in organizations. Despite the surge in research on digital leadership, there is still a gap in understanding its dimensions. This research investigates the determination of digital leadership based on style, role, and skill from various research articles and presents the dimensions of digital leadership.*

Design/Methodology/Approach: *The study collected 527 samples in Indonesia from employees who work at the staff level in a digital workplace and have undergone the digital transformation process to measure the dimensions of digital leadership. The collected data were analyzed with SPSS using the Exploratory Factor Analysis method.*

Findings: *Six dimensions were extracted in this research: the first factor was digital skills, the second factor was facilitating digital literacy, the third factor was supporting, the fourth factor was knowledge sharing, the fifth factor was openness to a growth mindset, and the sixth factor was transparency. The results of this research contribute to elucidating the term digital leadership through six dimensions of skill, role, and style, and provide guidance for measuring the digital leadership variable. Nonetheless, this study collected data from employees at the staff level in a digital workplace, so it should also gather data directly from managers and CEOs to provide another perspective on digital leadership.*

Practical Implication: *The implications of this research are to measure the competency of leaders in the digital era in terms of skill, role, and style, and to serve as a benchmark for choosing digital leaders.*

Originality/Value: *These findings contribute to addressing the gap between traditional leaders and digital leaders by using factor analysis to develop the dimensions of digital leadership.*

Keywords: *Digital skills, Digital literacy, Supporting, Knowledge, Transparency.*

JEL Classification: *M15, M12, O33, L21, D83.*

Paper type: *Research article.*

---

[1]Universitas Negeri Jakarta, Indonesia, e-mail: andreaswijaya15@gmail.com;

1. Introduction

Nowadays, almost all businesses are turning to digital methods. However, according to Harvard Business Review, almost 89% of large companies globally have a digital and AI transformation underway. Delving deeper, the data shows only 31% of the expected revenue lift and 25% of the expected cost savings from the effort.

Organizational transformation is challenging because people usually work within their established cultural systems, which are difficult to change. In the old paradigm, the theory of organizational change by Lewin (2015) established three processes: unfreeze, change, and refreeze, to set the status quo.

First, at the unfreeze stage, changing employee attitudes is a critical factor in supporting change. Evidence from previous research (Cartwright and Schoenberg, 2006; Washington and Hacker, 2005) shows that change initiatives often fail. It becomes crucial to study organizational change from macro, meso, and micro levels.

The macro level refers to the organizational capability to change, incorporating strategic plans to create change readiness and adaptability. The meso level refers to group processes supporting change, while the micro level addresses individual attitudes towards change.

Several researchers examined the link between individual and unit processes. Zeike *et al.* (2019) suggested that strengthening digital skills is foremost in tackling hurdles in digital transformation. Chatterjee *et al.* (2023) and Eberl and Drews (2021) investigated the role of leadership in developing group mechanisms, defining digital leadership as the social interactions between leaders and followers, associated with leadership style and technology information.

Thus, the role of leadership became prominent. Research from Avolio *et al.* (2000a) introduced the term digital leadership, describing it as a combination of leadership style and skills in using technology. This result encouraged other researchers to delve deeply into the meaning of digital leadership.

Digital leadership involves social interactions between leaders and followers, associated with leadership style and technology information. Leadership in the digital age has evolved into digital leadership, defined by Avolio *et al.* (2000b) and Salter *et al.* (2014) as social influence mediated by digital technology that can alter attitudes, feelings, thinking, behavior, and performance.

Research from Antonopoulou *et al.* (2020) describes digital leadership as the process of directing a group by integrating information and technology in the organizational environment. Bartsch *et al.* (2020) stated that digital leadership directs teams to work in a virtual environment.

On the one hand, the term digital has been concerned with the skill to use technology. Several researchers (Klus and Müller, 2021; Șișu, 2023) investigated the importance of leaders adopting new challenges.

Other researchers (Kane *et al.,* 2019; von Ohain, 2019) emphasized that leadership needs to be techno-savvy. Chatterjee *et al.* (2023) found that organizations must develop their abilities to use technology to drive digital transformation. Frankowska and Rzeczycki (2020) describe that digital leadership needs to create their role as collaborative network integrators (Karakose, 2021).

Digital leadership skills are needed to use technology in the digital age and support digital transformation. De Waal *et al.* (2016) explored the skills required for digital leadership to manage teams in organizations. Antonopoulou *et al.* (2020) interpret digital leadership as the process of directing a group to integrate information and technology in the organization with their skills (Sousa and Rocha, 2019). Leaders need to master the use of digital technologies (digital skills) to implement the results of digital transformation (Fernando *et al.,* 2023; Grima *et al.,* 2023).

On the other hand, regarding the definition of leadership, several researchers tend to examine the role of leadership in developing digitalization and leadership style to accompany groups (Erhan *et al.,* 2022; Popli and Rizvi, 2016). Various researchers (Ajmal *et al.,* 2012; Larson and DeChurch, 2020; Eberl and Drews, 2021; Bartsch *et al.,* 2020; Erhan *et al.,* 2022; Liao, 2017) suggest that the importance of digital leadership lies in their role and style of leading followers.

Eberl and Drews (2021) define digital leadership as a concept of connecting strategies that spark changes in digitalization, thereby giving leadership a crucial role in the cohesion of their team members. Peng (2022) states that in the era of digital technology, digital leadership should develop to lead others, teams, or entire organizations to influence digital implementation and ensure that their goals are achieved (Frankowska and Rzeczycki, 2020; Norena-Chavez and Thalassinos, 2023; 2022; Tyagi *et al.,* 2023; Velinov *et al.,* 2023).

Digital leadership needs to create their role as collaborative network integrators. Türk (2023) describes digital leadership in terms of the essence of the role and its characteristics in identifying group development. Besides the leadership role in coordinating the team, digital leadership requires a leader to influence their team, and therefore, the style of leadership should be considered (Bresciani *et al.,* 2021; Petry, 2019).

Previous researchers have addressed several aspects of leadership style in virtual teams. For example, DeSanctis and Poole (1994) began their research with an experimental study comparing two different leadership styles, including transactional and transformational leadership, in 60 virtual teams, each tasked with completing an assignment. Antonopoulou *et al.* (2020) captured two different

leadership styles in groups, such as transactional and transformational leadership, to lead teams. As a result, transformational leadership had a positive impact, whereas transactional leadership had no effect on performance.

Kozhevnikova and Starovoytova (2021) proposed that transactional leadership should be replaced with transformational leadership while managing virtual teams. Despite digital leadership often being measured by transformational and transactional styles, the dimensions of measurement are not yet rigorous. Other research (Prince, 2017) indicates that digital leadership overlaps with authentic, transactional, and transformational leadership and should be analyzed.

Therefore, this research will examine the styles of leadership—transformational, transactional, and authentic. Eberl and Drews (2021) elucidated that digital leadership overlaps with transactional, transformational, and authentic leadership. Based on these findings, the style of digital leadership needs to be further analyzed to determine the concept of digital leadership.

This encompasses various unexplored dimensions that have been attempted in other disciplines and should be explored further. Firstly, this research will contribute to developing the term digital leadership by determining the dimensions of digital leadership from leadership style, role, and skill. Thereby, the indicators of each finding will be analyzed to foster the dimensions of digital leadership.

2. Literature Review

This research scrutinizes Adaptive Structuration Theory to propose the framework of digital leadership. Orlikowski (1992) describes the relationship between technology (digital) and human agents of institutions.

Furthermore, Avolio *et al.* (2000a), Larson and DeChurch (2020), defined that Adaptive Structuration Theory was the board framework to investigate digital leadership, the effects of technology emerge from the interaction between teams on organizational structures and leadership is a part of accommodating the process.

Rains and Bonito (2017) explains Adaptive Structuration Theory (AST) is the use and effects between employee of technologies in organizations. Besides the Adaptive Structuration Theory had a wide range of frameworks, this research focused on group mechanisms, particularly in skill, role and style of the leader and dynamic relationship between the structures provided by technologies and how those structures are used by organizational members.

In the past, leadership has always been seen as a trait, style of behaviour, and most definitions of leadership are examined in three components of influence, group, and purpose.

Therefore, the change of information technology caused several organizations to change their management processes, it begin from the invention of the computer that was established from 1970, thus the leader continuously adopted the use of digital technologies (Karakose, 2021).

In addition, the pandemic of COVID-19 hitting hard organizations' performance and composed them to work from home, thereby almost all the organizations adopted in rapid change to new digital conditions. Thus, Oberer and Erkollar (2018) investigated leader support became important to achieve digital transformation.

Besides of digital leadership need the skills to use technology (Orero-Blat *et al.,* 2022) that effective leader still depends on traditional leadership that can support their leadership with digital skills.

Hence, the term of digital leadership has become more fascinating to explore. In recent years, (Espina-Romero *et al.,* 2023) digital leadership has garnered significant research interest, and numerous studies have been carried out on digital leadership in different research fields.

Salter *et al.* (2014) defined as a social influence mediated by digital technology that can altering attitudes, feeling, thinking, behaviour and performance.   Another research (Banks *et al.,* 2022) describes digital leadership as the process of directing a group by integrating information and technology in the organizational environment and Batırlık *et al.* (2022) stated that digital Leadership directs the team to work in a virtual environment.

Digital Leadership is described by Sow and Aborbie, (2018) as demonstration of strategies adoption positively influencing digital transformation processes. Digital Leadership is described by Bresciani *et al.* (2021) as influence from leaders to their subordinate to adopt strategies and demonstrated digital transformation processes.

Despite a lot of research had rising, research from Eberl and Drews (2021) concludes that still don't has a standardization for the dimension of digital leadership because of the style of leadership still needs attempt to be examined and not limited from traditional leadership (transformational, transactional, authentic).

According to the literature review about digital leadership, it can be concluded that could be measured using different indicators, to orient our examination about digital leadership and its relevance with the leadership style, role, and skill.

This research will determine the appropriate indicator to measuring the dimension of variables as Table 6.

Figure 1. *Venn Diagram of Digital leadership role, skills and style*

This study proposes initial overview of the literature from 2020 to the end of December 2023, the literature was searched in various databases using Publish or Perish 8 consisting of google scholar, Emerald, springer, and Science Direct. The search was based on the keywords " digital leadership". The result initial sample size of 78 journals and reduced by applying exclusion criteria, moreover this research gathered 8 journals which are above 10 citations/ year each journal explaining the change paradigm into digital transformation towards digital leadership.

Table 1. *Exclusion criteria and sample size*

Exclusion Criteria	Sample size after being reduced by criteria
Missing detail context of Digital Leadership	64
Absence of indicator to determine Digital Leadership	31
Similar content, research type, and reference	24

Source: *Own study.*

The review consists of three steps, firstly, we focus on the context of digital leadership, there was some journal missing detail about digital leadership. Secondly, we gave a code for every indicator to develop the determinants of digital leadership based on research journal and lastly, we collect the appropriate journal to arrange the determinants of digital leadership

3. Research Methodology

This research aims to determine the dimensions of digital leadership, therefore to conclude that this study conducted quantitative data and will be analyzed with EFA (Watkins, 2018). Exploratory Factor Analysis (EFA) is a multivariate statistical method used to establish underlying dimensions between variables and indicators (Williams *et al.,* 2010)

The data were collected from respondents who meet the criteria, such as, still work at digital workplace, passed successfully digital transformation to share the

appropriate determinant for digital leader, and have at least 3 years tenure work in Indonesia. The questionnaires were given using online questionnaires instrument from five points of Likert ranging from 1 (strongly disagree) to 5 (strongly agree)

There are several steps to use EFA. Firstly, the research will analyze the appropriate sample size. Refer to Hair *et al.* (2010), this test applied two criteria in assessing the adequacy of the data in factor analysis; secondly, this research measured by Kaiser Mayer Olkin to analyze the adequacy sample (KMO-SMA) and Bartlett's Test of Sphericity.

Our analysis is based on rule of thumb; the result of KMO-MSA should be between 0 to 1 and a significant test in Bartlett's Test of Sphericity. Bartlett's should be below 0.05 ($p < 0.05$). The next step in EFA analysis is reducing the large number of variables into dimensions using PCA and another approach can be used Eigenvalue, ccumulative percent of variance extracted, and scree plot test (Williams *et al.,* 2010).

Another criterion in determining factor extraction is the rotation method. This study also applied the varimax rotation to represent the factor that uncorrelated. After the rotation step, the final procedure is to give the label for the factor extracted by referring to the theory or relevant research

4. Research Results and Discussion

This research had collected 527 samples exceeded the criteria. Furthermore, there are several procedures to conclude EFA analysis. Firstly, anti image analysis, it measure every single item that determine digital leadership.

Table 2. *Anti Image Correlation*

Item	Anti image correlation	Item	Anti image correlation	Item	Anti image correlation
DL1	.870[a]	DL12	.893[a]	DL23	.906[a]
DL2	.845[a]	DL13	.843[a]	DL24	.894[a]
DL3	.942[a]	DL14	.883[a]	DL25	.840[a]
DL4	.896[a]	DL15	.909[a]	DL26	.848[a]
DL5	.859[a]	DL16	.872[a]	DL27	.850[a]
DL6	.925[a]	DL17	.871[a]	DL28	.852[a]
DL7	.942[a]	DL18	.882[a]	DL29	.795[a]
DL8	.923[a]	DL19	.927[a]	DL30	.815[a]
DL9	.900[a]	DL20	.927[a]	DL31	.836[a]
DL10	.870[a]	DL21	.888[a]	DL32	.771[a]
DL11	.900[a]	DL22	.908[a]	DL33	.876[a]

Source: *Own study.*

Based on Table 2 anti image correlation, the number of each item had surpass the rule of thumb 0,5 ((Watkins, 2018; Williams *et al.,* 2010). The next procedure is measuring the adequacy of sample size using KMO and Bartlett's Test.

Table 3. *KMO and Bartlett's Test*

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.880
Bartlett's Test of Sphericity	Approx. Chi-Square	25591.045
	df	528
	Sig.	.000

Source: Own study.

Looking Table 3, the KMO and the Barlett's test are presented. It shows that the number of Kaiser Meyer Olkin measure of sampling adequacy is 0.880 and exceeded the rule of thumb: >0.05 (Watkins, 2018; Williams *et al.,* 2010). Based on this finding, the next step could be proceed further. This research use PCA to extraction, the result shown by scree plot in Figure 2.

Figure 2. *Scree Plot*
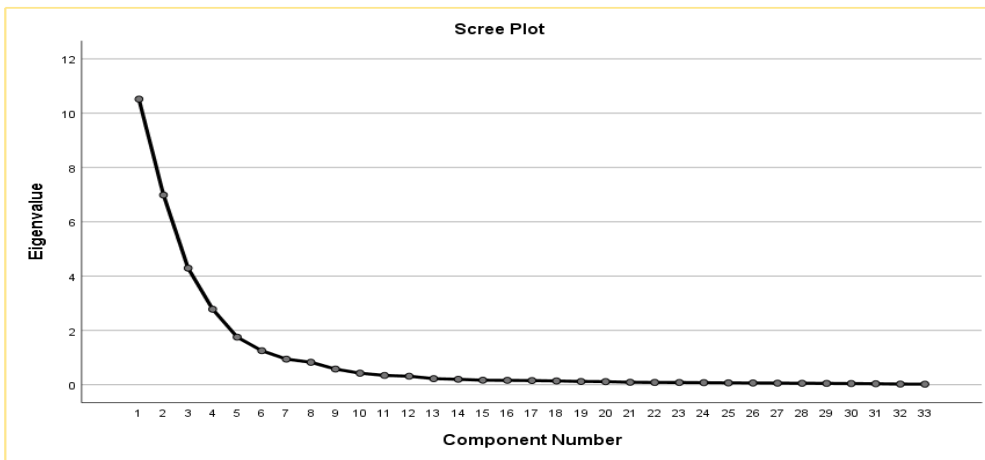
Source: Own study.

As presented in Figure 2, the numerous factors were reduced based on the Eigenvalue >1. Therefore it can be concluded that there are six factors above 1 from the scree plot, each of components from component 1 to component 6 accounted for 10.517, 6.985, 4.293, 2.779, 1.751, and 1.251 respectively. Another point that is important to be analyzed is loading cumulative. Looking for Table 4, this research had 83.561. According to Watkins (2018), and Williams *et al.* (2010), the minimum value of total cumulative variance is sixty percent, thus the cumulative variance was accepted.

Furthermore, the rotation matrix with varimax was conducted to explain the loading

factor to describe each item and classify it into groups (Watkins, 2018; Williams *et al.,* 2010).

The minimum score loading factor is 0.4, and from Table 4, the component is divided into 6 component, the first component consists of seven items; DL3, DL5, DL4, DL6, DL2, DL1, DL7; the second component including five items; DL21, DL22, DL23, DL19; the third component had six items; DL11, DL10, DL9, DL12, DL8, DL13; the forth component composed by five items; DL31, , DL33, DL30, DL29; the fifth component consists of six items; DL16, DL15, DL17, DL14, DL18; the sixth component contains five items; DL 27, DL26, DL25, DL24, DL28. Moreover, each item in the categories factor will be labeled by referring to previous research.

Table 4. *Total Variance Explained*

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.517	31.870	31.870	10.517	31.870	31.870	6.198	18.783	18.783
2	6.985	21.165	53.035	6.985	21.165	53.035	5.035	15.256	34.039
3	4.293	13.008	66.043	4.293	13.008	66.043	4.511	13.671	47.710
4	2.779	8.422	74.465	2.779	8.422	74.465	4.054	12.284	59.994
5	1.751	5.306	79.771	1.751	5.306	79.771	3.925	11.894	71.888
6	1.251	3.791	83.561	1.251	3.791	83.561	3.852	11.673	83.561
7	.941	2.851	86.412						
8	.826	2.503	88.916						
9	.576	1.746	90.662						
10	.424	1.284	91.946						
11	.341	1.035	92.981						
12	.312	.945	93.926						
13	.222	.672	94.598						
14	.198	.600	95.198						
15	.166	.502	95.700						
16	.160	.485	96.185						
17	.152	.460	96.645						
18	.138	.417	97.062						
19	.118	.359	97.421						
20	.114	.345	97.766						
21	.089	.270	98.036						
22	.084	.256	98.291						
23	.081	.245	98.537						
24	.076	.229	98.766						
25	.067	.203	98.969						
26	.063	.190	99.159						
27	.058	.174	99.333						
28	.052	.158	99.491						
29	.047	.143	99.634						
30	.042	.128	99.762						
31	.035	.107	99.868						
32	.023	.070	99.939						
33	.020	.061	100.000						

Extraction Method: Principal Component Analysis.

Source: *Own study.*

Therefore, six factors have been extracted in the rotation method using varimax and

will be labeled according to the previous study. According to Abbu *et al.* (2022) and Antonopoulou *et al.* (2020) the first factor categorized to digital skills, it reflects the skill of analyzing data, technology, social media, knowledge, and mastering digital skills.

The second factor based on Erhan *et al.* (2022), and Larson and DeChurch (2020) is labelled by facilitating digital literacy, including informative role, solving problems, ensuring understand, encouraging to experiment, raising awareness. According to Karakose (2021), and Singh (2021), the third factor is called supporting. It contains coordination, support learning, support technology-based, support digital transformation, openness collaboration, open communication.

Table 5. *Rotated Component Matrix*

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
DL3	.933					
DL5	.925					
DL4	.915					
DL6	.914					
DL2	.910					
DL1	.883					
DL7	.711					
DL21		.908				
DL20		.880				
DL22		.856				
DL23		.767				.506
DL19		.765				
DL11			.892			
DL10			.884			
DL9			.858			
DL12			.796			
DL8	.562		.644			
DL13			.629		.547	
DL31				.932		
DL32				.930		
DL33				.896		
DL30				.755		
DL29				.656		.513
DL16					.863	
DL15					.852	
DL17					.818	
DL14					.706	
DL18		.618			.644	
DL27						.854
DL26						.838
DL25						.770
DL24		.600				.700
DL28				.534		.695

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Source: *Own study.*

Next, the fourth factor is knowledge sharing (Zeike *et al.,* 2019; Singh, 2021; Abbu *et al.,* 2022) and reflects on give knowledge sharing, help get resources, encouraging to explore, insists knowledge, allowing employees to present their knowledge.

According to Petry (2019) and Erhan *et al.* (2022) the fifth factor is openness to a growth mindset, it includes learning quickly, being open to criticism, being open to receiving input, generating competence, and sharing contributing experience. Lastly, transparency is the sixth factor. It was developed by Bartsch *et al.* (2020), Singh (2021), and Abbu *et al.* (2022) and comprise of evaluated work processes, creating an open error culture, flexible working methods, giving reward and punishment based on performance, documented and accessible.

5. Conclusions, Proposals, Recommendations

In this research on Digital Leadership, several potential underlying dimensions of digital leadership in skill, role, and style were studied using factor analysis (EFA).

Six factors of digital leadership were extracted. As shown in Table 6, there were two dimensions in leadership skill: the first factor as digital skill and the fourth factor as knowledge sharing. The leadership role was constructed from the second factor as facilitating digital literacy and the fifth factor as openness to a growth mindset. Lastly, leadership style was developed by the third factor as supporting and the sixth factor as transparency.

The results of this article contribute to elucidating the term digital leadership through six dimensions of skill, role, and style, and also provide guidance for measuring the digital leadership variable. Nonetheless, this study collected data from employees at the staff level in a digital workplace. Therefore, it should also gather data directly from managers and CEOs to provide another perspective on digital leadership.

Table 6. Dimension of Digital Leadership

Scope	Dimension	No of Items	Items of Digital Leadership	Loading	Source
Leadership Skills	Digital Skills (Abbu et al., 2022) (Antonopoulou et al., 2020)	DL3	My leader had skills in analyzing big Data	.942	Antonopoulou et al., 2020)
		DL5	My leader has their own experience in digital skills	.859	(Abbu et al., 2022)
		DL4	My leader thinks using digital tools is easy and fun	.896	(Abbu et al., 2022)
		DL6	My leader can use certain of digital technology	.925	(Abbu et al., 2022)
		DL2	My leader always up to date" in digital knowledge	.845	(Antonopoulou et al., 2020)
		DL1	My leader had digital skills of Social Media	.870	(Antonopoulou et al., 2020)
		DL7	My leader uses data analytics to drive operational systems and strategic decisions	.942	(Abbu et al., 2022)
Leadership Role	Facilitating Digital literacy	DL21	My leader plays an informative role in reducing resistance toward	.888	(Erhan et al., 2022)

	(Erhan et al., 2022) (Larson and DeChurch, 2020)		information		
		DL20	My leader always solve the problem in the virtual team process	.927	(Larson and DeChurch, 2020)
		DL22	My leader ensures that team members have an understanding about technology	.908	(Larson and DeChurch, 2020)
		DL23	My leader created open space for the team to experiment	.906	(Erhan et al., 2022)
		DL19	My leader raises awareness about technology that can be used to improve organizational process to employee	.927	(Erhan et al., 2022; Karakose, 2021)
Leadership Style	Supporting (Karakose, 2021) (Singh, 2021)	DL11	My leader always coordinate the team members to collaborative	.900	(Singh, 2021)
		DL10	My leader Supports for digital learning culture	.870	(Karakose, 2021)
		DL9	My leader Supports for technology-based professional development	.900	(Karakose, 2021)
		DL12	My leader supports openness Collaboration	.893	(Singh, 2021)
		DL8	My leader Supports for digital transformation	.923	Karakose (2021)
		DL13	My leader Open Communication	.843	(Singh, 2021)
Leadership Skills	Knowledge sharing (Zeike et al., 2019) (Singh, 2021) (Abbu et al., 2022)	DL31	My leader give knowledge as direction to exceeded the key performance indicators	.836	(Zeike et al., 2019)
		DL32	My leader helps the team to get the resources required for collaborative learning project	.771	(Singh, 2021)
		DL33	My leader always act and encourage to explore the new knowledge about digitalization	.876	(Singh, 2021)
		DL30	My leader insists knowledge to develop digital transformation.	.815	(Abbu et al., 2022
		DL29	My leader allow every employee to present their knowledge about digital transformation	.795	(Abbu et al., 2022
Leadership Role	Opennes to growth mindset (Petry, 2019) Erhan et al., (2022)	DL16	My leader Learn quickly from success and failure Participation	.872	(Petry, 2019)
		DL15	My leader Open to criticism	.909	(Petry, 2019)
		DL17	My leader generate competence	.871	(Petry, 2019)
		DL14	My leader Open to receive input	.883	(Petry, 2019)
		DL18	My leader share own experience about technological opportunities will increase contribution	.882	(Erhan et al., 2022)
Leadership Style	Transparency (Bartsch et al., 2020) (Singh, 2021) (Abbu et al., 2022	DL27	My leader evaluate work processes and working methods according to suitable key performance indicators	.850	(Bartsch et al., 2020)
		DL26	My leader create an open error culture in the team	.848	(Bartsch et al., 2020)
		DL25	My leader enable the usage of flexible working methods in the team	.840	(Bartsch et al., 2020)
		DL24	My leader make sure the digital strategy is documented and accessible to all stakeholders.	.894	(Abbu et al., 2022
		DL28	My leader fair giving reward and punishment based on performance	.852	(Singh, 2021)

Source: *Own study.*

References:

Abbu, H., Mugge, P., Gudergan, G., Hoeborn, G., Kwiatkowski, A. 2022. Development of an Instrument for Measuring the Human Dimensions of Digital Leaders. Research-Technology Management, 65(3).

Ajmal, S., Farooq, M. Z., Sajid, N., Awan, S. 2012. Role of leadership in change management process. Abasyn Journal of Social Sciences, 5(2).

Antonopoulou, H., Halkiopoulos, C., Barlou, O., Beligiannis, G.N. 2020. Leadership types and digital leadership in higher education: Behavioural data analysis from University of Patras in Greece. International Journal of Learning, Teaching and Educational Research, 19(4). https://doi.org/10.26803/ijlter.19.4.8.

Avolio, B.J., Kahai, S., Dodge, G.E. 2000a. E-leadership: Implications for theory, research, and practice. Leadership Quarterly. https://doi.org/10.1016/s1048-9843(00)00062-x.

Avolio, B.J., Kahai, S., Dodge, G.E. 2000b. E-leadership: Implications for theory, research, and practice. Leadership Quarterly. https://doi.org/10.1016/s1048-9843(00)00062-x.

Banks, G.C., Dionne, S.D., Mast, M.S., Sayama, H. 2022. Leadership in the digital era: A review of who, what, when, where, and why. Leadership Quarterly, Vol. 33, Issue 5. https://doi.org/10.1016/j.leaqua.2022.101634.

Bartsch, S., Weber, E., Büttgen, M., Huber, A. 2020. Leadership matters in crisis-induced digital transformation: how to lead service employees effectively during the COVID-19 pandemic. Journal of Service Management. https://doi.org/10.1108/JOSM-05-2020-0160.

Batırlık, S.N., Gencer, Y.G., Akkucuk, U. 2022. Global Virtual Team Leadership Scale (GVTLS) Development in Multinational Companies. Sustainability, 14(2). https://doi.org/10.3390/su14021038.

Bresciani, S., Ferraris, A., Romano, M., Santoro, G. 2021. Digital Transformation Management for Agile Organizations: A Compass to Sail the Digital World. In: Digital Transformation Management for Agile Organizations: A Compass to Sail the Digital World. https://doi.org/10.1108/9781800431713.

Cartwright, S., Schoenberg, R. 2006. Thirty years of mergers and acquisitions research: Recent advances and future opportunities. British Journal of Management, Vol. 17, Issue Suppl. 1. https://doi.org/10.1111/j.1467-8551.2006.00475.x.

Chatterjee, S., Chaudhuri, R., Vrontis, D., Giovando, G. 2023. Digital workplace and organization performance: Moderating role of digital leadership capability. Journal of Innovation and Knowledge, 8(1). https://doi.org/10.1016/j.jik.2023.100334.

De Waal, B., Van Outvorst, F., Ravesteyn, P. 2016. Digital Leadership: The Objective - Subjective Dichotomy of Technology Revisited. ECMLG 2016 - Proceedings of the 12th European Conference on Management, November.

Eberl, J.K., Drews, P. 2021. Digital Leadership – Mountain or Molehill? A Literature Review. Lecture Notes in Information Systems and Organisation, 48 LNISO. https://doi.org/10.1007/978-3-030-86800-0_17.

Erhan, T., Uzunbacak, H.H., Aydin, E. 2022. From conventional to digital leadership: exploring digitalization of leadership and innovative work behavior. Management Research Review, 45(11). https://doi.org/10.1108/MRR-05-2021-0338.

Espina-Romero, L., Noroño Sánchez, J.G., Rojas-Cangahuala, G., Palacios Garay, J., Parra, D.R., Rio Corredoira, J. 2023. Digital Leadership in an Ever-Changing World: A Bibliometric Analysis of Trends and Challenges. Sustainability, Vol. 15, Issue 17. https://doi.org/10.3390/su151713129.

Fernando, K.D.U.D., Tharanga, T.M.N., Dewasiri, N.J., Sood, K., Grima, S., Thalassinos, E.

2023. Insurance Penetration and Institutional Spillover on Economic Growth: A Dynamic Spatial Econometric Approach on the Asian and Europe Region. Journal of Risk and Financial Management, 16(8), 365.

Frankowska, M., Rzeczycki, A. 2020. Reshaping Supply Chain Collaboration - The Role of Digital Leadership in a Networked Organization. IFIP Advances in Information and Communication Technology, 598. https://doi.org/10.1007/978-3-030-62412-5_29.

Grima, S., Thalassinos, E.I., Cristea, M., Kadłubek, M., Maditinos, D., Peiseniece, L. (Eds.). 2023. Digital transformation, strategic resilience, cyber security and risk management. Emerald Publishing Limited.

Hair, J., Black, W., Babin, B., Anderson, R. 2010. Multivariate Data Analysis: A Global Perspective. Multivariate Data Analysis: A Global Perspective.

Kane, G.C., Phillips, A.N., Copulsky, J., Andrus, G. 2019. How digital leadership is(n't) different. MIT Sloan Management Review, 60(3).

Karakose, T. 2021. The impact of the COVID-19 epidemic on higher education: Opportunities and implications for policy and practice. Educational Process: International Journal, 10(1). https://doi.org/10.22521/EDUPIJ.2021.101.1.

Klus, M., Müller, J. 2021. Identifying Leadership Skills Required in the Digital Age. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3564861.

Kozhevnikova, L.V., Starovoytova, I.E. 2021. Transformation Leadership in Virtual Teams. Vestnik Universiteta, 2. https://doi.org/10.26425/1816-4277-2021-2-30-35.

Lamaree, E., et al. 2023. The value of digital transformation. Havard Business Review. Avaiable online at: https://hbr.org/2023/07/the-value-of-digital-transformation.

Larson, L., DeChurch, L.A. 2020. Leading teams in the digital age: Four perspectives on technology and what they mean for leading teams. Leadership Quarterly, 31(1). https://doi.org/10.1016/j.leaqua.2019.101377.

Lewin, K. 2015. Lewin's Change Management Model. Mind Tools Ltd.

Liao, C. 2017. Leadership in virtual teams: A multilevel perspective. Human Resource Management Review. https://doi.org/10.1016/j.hrmr.2016.12.010.

Norena-Chavez, D., Thalassinos, E. 2023. Impact of big data analytics in project success: Mediating role of intellectual capital and knowledge sharing. Journal of Infrastructure, Policy and Development, 7(3).

Norena-Chavez, D., Thalassinos, E.I. 2022. Transactional Leadership and Innovative Behavior as Factors Explaining Emotional Intelligence: A Mediating Effect. Journal of Risk and Financial Management, 15(12), 545.

Oberer, B., Erkollar, A. 2018. Leadership 4.0: Digital Leaders in the Age of Industry 4.0. International Journal of Organizational Leadership, 7(4). https://doi.org/10.33844/ijol.2018.60332.

Orero-Blat, M., de Juan Jordán, H., Palacios-Marqués, D. 2022. A literature review of causal relationships in 21st century skills and digital leadership. International Journal of Services Operations and Informatics, Vol. 12, Issue 1. https://doi.org/10.1504/IJSOI.2022.123567.

Orlikowski, W.J. 1992. The Duality of Technology: Rethinking the Concept of Technology in Organizations. Organization Science, 3(3). https://doi.org/10.1287/orsc.3.3.398.

Peng, B. 2022. Digital leadership: State governance in the era of digital technology. Cultures of Science, 5(4). https://doi.org/10.1177/2096608321989835

Petry, T. (2019). Digital Leadership – Unternehmens- und Personalführung im digitalen Zeitalter. Digital Leadership : Erfolgreiches Führen in Zeiten Der Digital Economy.

Popli, S., Rizvi, I.A. 2016. Drivers of employee engagement: The role of leadership style. Global Business Review, 17(4). https://doi.org/10.1177/0972150916645701.

Prince, K.A. 2017. Digital leadership: transitioning into the digital age. In: Iceb.

Rains, S.A., Bonito, J.A. 2017. Adaptive Structuration Theory. The International Encyclopedia of Organizational Communication. https://doi.org/10.1002/9781118955567.wbieoc003.

Salter, C.R., Harris, M.H., McCormack, J. 2014. Bass and Avolio's Full Range Leadership Model and Moral Development. E-Leader Milan.

Singh, R. 2021. Information Exchange at a Distance: Examining the Influence of Leadership on Knowledge Sharing in Virtual Teams. Journal of the Australian Library and Information Association, 70(2). https://doi.org/10.1080/24750158.2020.1761090.

Șișu, J.A. 2023. Digital Leadership Competencies: A Systematic Literature Review. Review of International Comparative Management, 24(1).

Sousa, M.J., Rocha, Á. 2019. Digital learning: Developing skills for digital transformation of organizations. Future Generation Computer Systems, 91. https://doi.org/10.1016/j.future.2018.08.048.

Sow, M., Aborbie, S. 2018. Impact of Leadership on Digital Transformation. Business and Economic Research, 8(3). https://doi.org/10.5296/ber.v8i3.13368.

Türk, A. 2023. Digital leadership role in developing business strategy suitable for digital transformation. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.1066180.

Tyagi, P., Grima, S., Sood, K., Balamurugan, B., Özen, E., Thalassinos, E.I. (Eds.). 2023. Smart analytics, artificial intelligence and sustainable performance management in a global digitalised economy. Emerald Publishing Limited.

Velinov, E., Kadłubek, M., Thalassinos, E., Grima, S., Maditinos, D. 2023. Digital Transformation and Data Governance: Top Management Teams Perspectives. In Digital Transformation, Strategic Resilience, Cyber Security and Risk Management (Vol. 111, pp. 147-158). Emerald Publishing Limited.

von Ohain, B.P. 2019. Leader attributes for successful digital transformation. 40th International Conference on Information Systems, ICIS 2019.

Washington, M., Hacker, M. 2005. Why change fails: Knowledge counts. Leadership and Organization Development Journal, 26(5). https://doi.org/10.1108/01437730510607880.

Watkins, M.W. 2018. Exploratory Factor Analysis: A Guide to Best Practice. Journal of Black Psychology, 44(3). https://doi.org/10.1177/0095798418771807.

Williams, B., Onsman, A., Brown, T. 2010. Exploratory factor analysis: A five-step guide for novices. Journal of Emergency Primary Health Care, 8(3). https://doi.org/10.33151/ajp.8.3.93.

Zeike, S., Bradbury, K., Lindert, L., Pfaff, H. 2019. Digital leadership skills and associations with psychological well-being. International Journal of Environmental Research and Public Health, 16(14). https://doi.org/10.3390/ijerph16142628.