

Research Status and Prospect of Digital Leadership

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Abstract: Digital economy has become a new driving force for China's economic development, and digital leadership is an important guarantee to promote the digital transformation of organizations. This paper systematically combs the concept and characteristics of digital leadership, expounds the measurement methods of digital leadership, summarizes the formation mechanism and influence mechanism of digital leadership, and analyzes many deficiencies in the current research on digital leadership. Finally, on the basis of the previous research, this paper points out the research prospect of digital leadership, tries to combine the latest research results and advanced experience of digital leadership in western developed countries with China's actual national conditions, develop the digital leadership theory with Chinese characteristics, dialogue with the international frontier and prosperity of theoretical development, and provide Chinese wisdom and solutions for the research of digital leadership. To promote the high quality development of digital economy.

1. Introduction

At present, China is in a critical period of Digital transformation. Actively cultivating digital leadership can help organizations to achieve Digital transformation and promote high-quality development of organizations. Digital transformation accelerates the upgrading of organizational digital governance capabilities, leading to the expansion and expansion of the time-space boundary of management work. Organizations need to understand and respond to the challenges of Digital transformation in the digital environment. Therefore, actively cultivating digital leadership plays a huge role in promoting the organization's Digital transformation, and helps the organization to successfully carry out digital transformation and change [1].

This article summarizes the relevant literature on digital leadership. Firstly, it introduces the definition of digital leadership by domestic and foreign scholars. Secondly, it summarizes the measurement, formation mechanism, and impact mechanism of digital leadership. Finally, based on the previous summary, it discusses the areas that need to be improved in this field, attempting to provide reference and direction for scholars' subsequent related research.

2. Concepts and Characteristics of Digital Leadership

2.1. The Concept of Digital Leadership

Digital leadership can be traced back to the research of American scholar AVOLIO in 2000, but it should be pointed out that this study involves E-leadership, which refers to electronic leadership and information leadership. It is the embryonic definition of digital leadership, not the current meaning of digital leadership, and there is still a significant gap with the concept of digital leadership we have mentioned so far.

Later, scholars conducted rich discussions on the concept and connotation of digital leadership, but overall, existing research was relatively scattered. Scholars mostly proposed concepts from their own research perspectives, but did not reach a theoretical consensus. The relevant definitions are detailed in Table 1.

Table 1: Summary of basic concepts of digital leadership

Author (year)	Conceptual expression
Avolio(2014)	Digital leadership refers to the social impact process in which leaders use various information technologies to make organizational behavior subject change in attitude, emotion, thinking, behavior and performance [2].
Larjovuori(2016)	Digital leadership refers to the ability of leaders to create a clear and meaningful vision for the digital process, as well as the ability to execute strategies to achieve digitalization [3].
Elsawy(2016)	Digital leadership refers to what leaders do to drive the digital strategic success of businesses and their commercial ecosystems [4].
Zhong(2017)	Digital leadership refers to leaders' use of digital teaching technologies such as digital devices, services, and resources to create a digital learning culture, motivate organizational digital transformation, support professional development based on digital technology, provide and maintain digital organizational management, and promote and manage digital citizens [5].
Roman(2019)	Digital leadership is a series of technology mediated processes of social impact aimed at changing the attitudes, emotions, thinking, behavior, and performance of others [6].
Vanwart(2019)	Digital leadership refers to the ability of leaders to effectively utilize and fuse informatics with traditional communication technologies, selectively adopt emerging ICT for themselves and organizations [7].
Men Lixiang(2020)	Digital leadership refers to the ability and process of leaders to use digital technology to promote changes in attitudes, emotions, thinking, behavior, and performance among individuals, groups, and organizations [8].

2.2. Characteristics of Digital Leadership

By reviewing the relevant literature mentioned above, it can be found and summarized that there are three characteristics in the research on the concept of digital leadership.

2.2.1. Digital Leadership Relies on Digital Resources to Exert Influence

Unlike traditional leadership, leaders use digital technology as a production tool in the digital technology transformation environment, utilizing digital equipment, services, and technology to establish organizational member relationships. It emphasizes the important role of leaders adopting and using digital technology, including the leadership process of selecting digital technology for the organization and their own ability to use digital technology. Digital leaders are able to use digital

resources such as technology and equipment to guide teams towards achieving common goals [9].

2.2.2. Digital Leaders Have Digital Literacy

Most scholars pointed out that in the process of Digital transformation, leaders should have a strong desire to learn and understand roles, improve their digital skills and literacy, elaborate on digital technology related knowledge, establish and maintain responsible teams, cultivate a sense of trust in the virtual environment, and improve the agility and adaptability of organizations to change, have the ability to make top-level design and scientific decisions based on digital technology at the practical level of organizational Digital transformation [10].

2.2.3. Digital Leaders Should Be Empathic

Scholars believe that digital leaders aim to influence the cognition, emotions, and behavior of followers, and this effectiveness cannot be separated from the "empathy" ability of emotional infection. Digital leadership should have the ability to perceive and experience the emotions of followers, interpret digital situations from the perspective of followers, and achieve emotional interaction through empathy, empathy, and empathy [11].

Therefore, Digital transformation is the main challenge facing organizational leaders at present, and the use of digital technology as a production tool has changed the original appearance and texture of the organization, which requires a fundamental and disruptive Digital transformation of the organization to adapt to the digital environment. Digital leadership is a skill that must be possessed by leaders. Digital innovation promotes Digital transformation and challenges theoretical consensus such as leaders' self-centered authority and top-down control. Digital leaders should accurately interpret the increasingly complex digital environment and improve their digital leadership. Based on literature review and sorting, this paper defines digital leadership as "digital leadership is a kind of ability to respond to the digital environment. Organizational leaders use a series of digital resources to affect the attitude, emotion and behavior of organizational behavior subjects, identify and develop their own skills and skills needed to implement Digital transformation, and ultimately promote Digital transformation of the organization".

3. Measures of Digital Leadership

Due to the fact that digital leadership belongs to a relatively cutting-edge research field, especially the lack of a scientifically comprehensive dimensional structure and scale for digital leadership, it greatly increases the difficulty of measuring digital leadership. Therefore, research in this area is extremely limited.

3.1. Measure Study of Some Scholars

Zeike anchored digital leadership as an attitude dimension and a skill dimension, and designed a six item measurement scale [12]. The example question "I think digital tools are very interesting" and "I can make others enthusiastic about Digital transformation" emphasized that digital leadership should have the attitude required to use digital technology and the ability to implement digital strategies within the organization, as well as a clear understanding of the process of Digital transformation. This scale has been used in empirical research related to leadership due to its strong operability, but there are issues such as a general dimension division and overly simplistic setting of some items. Its reliability and validity need to be verified.

Roman constructed an SEC model of digital leadership from a theoretical perspective, dividing it into six abilities: digital communication, digital social, digital change, digital team, digital

technology, and digital trust [13].

Domestic scholar Li Yanping constructed the structural dimension of enterprise digital leadership based on Grounded theory, anchored digital leadership into five capability dimensions, including digital strategic thinking, digital environment control, digital organizational change, digital talent development, and digital communication and social networking, but did not develop corresponding measurement scales [14].

3.2. Inadequacies of Research on Digital Leadership Measures

In order to effectively and scientifically measure digital leadership, some scholars have attempted to conduct research from multiple perspectives and methods. However, there are relatively few such literature, and some research methods have significant shortcomings, which require further systematic research. The current research on measuring digital leadership has the following shortcomings.

3.2.1. Measures do not Comprehensively Reflect the Connotation and Epitaxy of Digital Leadership

There is a relative lack of research on the measurement of digital leadership scales, and their existing scales focus on digital skills and other aspects, emphasizing instrumental rationality characteristics. They lack attention to value rationality such as psychology, emotions, and emotions, resulting in a failure to fully and accurately reflect the connotation and extension of digital leadership.

3.2.2. Lack of an Indigenization Scale Suitable for China's National Conditions

The existing digital leadership scale focuses on the Western context, while China and advanced Western countries have different cultural backgrounds, institutional foundations, and organizational environments. Simply using the Western digital leadership scale to describe digital leadership in the Chinese context may lead to "acclimatization". Therefore, developing a digital leadership measurement scale in the context of China should become the fundamental work for domestic scholars to develop digital leadership theory.

4. Formative Mechanisms of Digital Leadership

Scholars generally believe that digital leadership is of great significance in helping organizations adapt to the digital environment and promoting Digital transformation of organizations. How to build effective digital leadership has become a proposition with theoretical value. However, digital leadership is still in the stage of conceptual framework improvement, and there is a lack of relevant research on the formation mechanism of digital leadership. Based on relevant literature findings, it is found that the formation mechanism of digital leadership can be classified into two categories: attitude and trait.

4.1. Attitude Class

It mainly emphasizes the degree of leaders' acceptance of Digital transformation. Liu et al. proposed an information technology adoption model for digital leadership, pointing out that "focusing on the initiative of digital technology", "evaluating the applicability of digital technology", and "willingness to use digital technology" are the three pre factors for building individual level digital leadership, with leader energy, analytical ability, and sense of responsibility becoming

effective predictive indicators [15]. Anghel pointed out that the Digital transformation of an organization not only depends on the technical expertise of leaders, but also needs to analyze the overall perception of leaders to accept the combination of digital technology and the organization, specifically including positive mental attitude, skills and roles, strategic leadership, employee recognition, resource utilization and leadership commitment [16]. Among them, insufficient leadership commitment will delay the process of Digital transformation of the organization.

4.2. Trait Class

The main emphasis is on the characteristics of leaders such as "agility" and "exploration". Harkiolakis proposed that in the process of organizing Digital transformation, leaders should have the ability to explore in the digital field with unknown directions, identify the path of Digital transformation in the complex and dynamic digital environment, and realize "digital entrepreneurship" [17]. Wagner et al. pointed out that in the context of the digital age, leaders need to re-examine the concept of internal work within organizations, create exploratory capabilities that can gradually enhance business, provide disruptive innovation, and challenge existing business model structures [18].

In summary, there are few systematic studies on the formation mechanism of digital leadership, and there are the following shortcomings: firstly, most researchers only logically deduce the constituent elements of digital leadership from their own research perspective, resulting in a lack of consistency in the research conclusions, making it difficult to dialogue between literature and integrate relevant theories; Secondly, the research on digital leadership based on Western contexts is difficult to effectively guide the development of digital leadership in China. Given the current lack of research on the formation mechanism of digital leadership in the Chinese context, subsequent research should be based on the local context of China in order to enrich the theory of digital leadership.

5. Mechanisms of Impact of Digital Leadership

Digital leadership emphasizes the way of using digital resources to influence others' practical activities to achieve organizational goals, which reflects the ability of leaders to promote the participation of actors in the organization in Digital transformation, as well as to identify and develop the skills and capabilities needed by themselves and others to implement change [19]. Therefore, the research on the impact mechanism of digital leadership on related outcome variables has become the focus of scholars' attention. Based on relevant literature findings, the impact mechanisms of digital leadership can be summarized as creative innovation and psychological emotion.

5.1. Creating Innovation Classes

Scholars describe digital leadership as the ability of one person to motivate a group of people, where leaders work together to achieve change goals by activating the innovative potential of organizational members. Kark et al. also believed that leaders use digital technology, tools, equipment and other resources to strengthen the self-efficacy of subordinates, so as to promote the innovation initiative of subordinates [20]. Almatrooshi et al. pointed out that the digital economy relies on massive amounts of data and digital equipment, causing organizational innovation work to be full of risks and complexity. In order to encourage individuals to actively integrate into challenging innovation work, digital leadership needs to continuously cultivate individuals' innovative digital thinking and encourage them to seek data-driven solutions [21].

Hartinah et al. found that individuals are more willing to explore innovative thinking in online space exploration after being encouraged and supported by digital leaders [22]. In recent empirical studies using university teachers as samples, it was also found that when schools provide digital leadership models, teachers' teaching creativity will be improved [23]. From this perspective, the positive correlation between digital leadership and organizational innovation reflects the transformative ability of leaders to inspire organizational members to achieve innovative outcomes [24].

5.2. Psychoemotional Class

Part of the research focuses on the correlation between digital leadership and individual psychological variables. On the one hand, digital leadership has a positive aftereffect in promoting individual psychological states. Rany et al. found that during the COVID-19, the digital leadership skill dimension had a significant impact on mental health, but the attitude dimension had no significant impact on mental health [25]. The conclusion shows that digital leadership is regarded as an effective resource to enhance enterprise competitiveness. Miller also pointed out that digital leadership enhances others' happiness and living conditions by utilizing digital facilities such as mass media and the internet [26].

On the other hand, digital leadership also has a negative side to some extent. Digital leadership uses digital resources to exert influence. The changes in working conditions and environment caused by digital leadership cause a decline in individual job security, induce employees to have negative emotions and consume a lot of psychological resources [27]. If digital monitoring triggers negative perceptions of employee distrust and reduces employee satisfaction [28]. Stone et al. pointed out that the two-way communication between leaders and employees has transformed into the use of digital resources by digital leaders to record, monitor, and provide feedback on individual communication among employees [29]. Relying too much on digital resources can actually create an invisible "digital divide" between leaders and members, exacerbating the emotional experience and psychological resistance of employees. Furthermore, digital leaders rely on feature-rich algorithm recommendations and intelligent tools for quantitative control assessment, leading to a trend of "de skilled" human resource management practices [30]. Leaders' evaluation of employees does not rely on experience and intuitive judgments, but rather gives way to digital technology, which to some extent reduces employees' emotional commitment and sense of belonging.

Based on the above conclusions, it can be seen that digital leadership is the result of combining creative leadership skills and digital capabilities, and then has an impact on the main body of organizational behavior. On the one hand, the convenience, immediacy and universality of digital technology promote the "everyone connected" among leading members, and help digital leaders use digital technology to improve the efficiency of human resources management, such as promoting employees to accept Digital transformation so as to smoothly realize organizational change and greatly improve organizational innovation ability.

On the other hand, digital leadership also creates relatively unbalanced and loose leadership member relationships, increasing employees' emotional discomfort and psychological resistance. The reason is that the excessive use of digital resources hinders two-way communication between leaders and members, and employees are "speechless" in areas such as significant job content, work condition selection, and reasonable performance concerns. In addition, the information asymmetry caused by algorithm concealment intensifies the control of leaders over employees, making it difficult for marginalized employees to have a good psychological experience. In fact, even in the field of innovation and creation, digital leadership also has a negative side. For example, recent research shows that when employees focus on digital data and ignore the original activities of the

organization based on Digital transformation, digital leadership will have a negative impact on employees' innovation behavior [31].

6. Conclusion and Prospect

In summary, research on digital leadership is still in its early stages, and the concept statement of digital leadership is relatively scattered and has not yet formed a system; Due to the lack of scientific measurement tools, the measurement of digital leadership needs further breakthroughs; The exploration of the formation and impact mechanisms of digital leadership is relatively scarce, leading to the stagnation of relevant empirical research and seriously affecting the research boundaries of digital leadership.

By summarizing and sorting out predecessors, important theoretical guidance has been provided for this article and direction has been pointed out for future research. The dynamics of digital leadership research are reflected in the following three aspects.

6.1. Integration of Research Outcomes under Digital Leadership

Scholars at home and abroad have conducted detailed research on the definition of digital leadership. However, overall, the research on the concept of digital leadership in the academic community is still in the exploratory stage, and the conceptual framework has only begun to take shape. Many scholars have explored it from their own research perspectives, resulting in a lack of unity in the connotation, structural dimensions, and measurement tools of digital leadership related concepts, which poses difficulties for the academic community to understand the theory of digital leadership. Therefore, it is necessary to integrate the research results of digital leadership, further clarify the connotation and extension of the concept, in order to lay a solid foundation for subsequent research on measurement.

6.2. Research Method Diversity in Digital Leadership

The study of digital leadership adopts quantitative research methods, such as obtaining first-hand data through original questionnaires; alternatively, qualitative research methods such as exploratory case studies and structured interviews may be used, but there are relatively few case studies or reports on digital leadership. The research sample mainly focuses on executives themselves, with a focus on European and American countries. Research on Chinese organizations as the research object is rarely seen in the literature. Therefore, how to scientifically measure digital leadership requires enriching research methods, further breaking through measurement tools and scope, and laying the foundation for subsequent empirical research based on the impact mechanism of digital leadership.

6.3. Deepening the Research Content of Digital Leadership

Digital leadership is currently mainly in the conceptual discussion stage, but some studies have gradually explored the impact mechanism of digital leadership and conducted corresponding empirical analysis. However, the research results have not formed a systematic system and are only scattered in the fields of innovative behavior and psychological emotions. In addition, the mediating variables and boundary conditions of the influence mechanism of digital leadership, as well as mitigating the negative effects of digital leadership, will become the focus of future research.

In short, the digital economy has become an important driving force for high-quality economic development, and digital leadership is an important guarantee for promoting the Digital

transformation of organizations. Compared to developed Western countries, the research on digital leadership in China started relatively late, with a small number and uneven quality of academic discussions and research results. It is difficult to provide advanced theoretical support for the development of China's digital economy and enterprise digital innovation, and it is also unable to effectively guide China's management practices. How to combine the latest research achievements and advanced experiences of digital leadership in developed Western countries with China's actual national conditions, develop digital leadership theories with Chinese characteristics, engage in dialogue with international frontiers, and prosper theoretical development, providing Chinese wisdom and solutions for digital leadership research, is a key issue that Chinese scholars should study.

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