



The Impact of Digital Leadership on Enterprise Sustainable Development Under the Background of “Industry 4.0”

Yiping Liu^(✉)

North China Electric Power University, Baoding 071066, Hebei Province, China
220201080313@ncepu.edu.cn

Abstract. With the advent of the era of “Industry 4.0”, a large number of enterprises are facing the transformation from automation to intelligence. The wave of “Industry 4.0” will bring huge economic growth opportunities and development challenges. Only by adopting positive sustainable development strategies can we deal with the impact from all aspects in the era of “Industry 4.0”. However, how does the internalization of digital leadership fit into the context of sustainable business development? This study found that from a cognitive perspective, enterprises will rethink the industry layout from a digital perspective, and carefully consider the relationship between short-term and long-term interests, and local and overall interests of enterprises so that enterprises can more accurately judge their future development. From the perspective of behavior, digital Leadership provides support, control, and feedback for enterprise management, reduces enterprise management costs, and improves enterprise operation efficiency. From a cultural perspective, digital leadership promotes enterprises to form an innovative, diversified, and noble corporate culture. From an environmental perspective, digital leadership can help enterprises achieve sustainable development based on a clear, accurate, and timely understanding of their own and external conditions.

Keywords: Industry 4.0 · Digital leadership · Digital transformation · Sustainability · Enterprise management

1 Introduction

1.1 Research Background

With the advent of the era of “Industry 4.0”, a large number of enterprises are facing the transformation from automation to intelligence. The wave of 4.0 will bring huge economic growth power and innovation opportunities. In the future, a large number of automatic operations will be replaced by intelligent operations. The cost advantage is not only reflected in the reduction of labor cost after the upgrading of the production line but also in the reduction of means of production and operation cost brought by the integrated upstream and downstream digital allocation system and lean and customized production, which creates more opportunities for the development of enterprises but also

puts forward higher requirements. If enterprises want to achieve good development under the background of reform, they must follow the principle of sustainable development and adopt positive sustainable development strategies to deal with the impact from all aspects in the era of “Industry 4.0”.

Leadership has always been a key factor affecting the development of enterprises. To successfully realize digital transformation, enterprises need to internalize leadership into personalized digital leadership that matches business characteristics and cultural atmosphere. Only by matching the digital leadership with the principle of sustainable development can enterprises better guide enterprises in the right direction from the macro level and implement the sustainable development strategy from the micro level.

1.2 Research Objective

The purpose of this paper is to sort out relevant work, and put forward some key and feasible future directions, to provide a reference for enterprises to achieve sustainable development under the background of “Industry 4.0” and the epidemic situation.

1.3 Paper Organization

The origin, definition, characteristics, and impact of “Industry 4.0”— > The origin, definition, and connotation of Corporate Sustainability— > The origin, definition, and connotation of digital leadership— > The effect of digital leadership on the Corporate Sustainability.

2 “Industry 4.0”

2.1 The Origin, Definition of “Industry 4.0”

The “Industry 4.0” strategy proposed by the German government and officially launched at the Hannover Messe in April 2013 is aimed at increasing the competitiveness of German industry, which is driven by the digitization of production processes in several industrial sectors, and then taking the lead in the new development situation. Since the official launch of the name, “Industry 4.0” has quickly become another label in Germany and has sparked a new round of industrial transformation races around the world.

The proposal of “Industry 4.0” has triggered a lot of discussions, and formed different perspectives for defining it. “Industry 4.0” is an industrial development stage in which new information technologies such as artificial intelligence, block-chain, cloud computing, 5G, Internet of Things, and big data are used to realize the transformation of traditional industrial production methods to digitalization and intelligence. Its purpose is to improve the efficiency of communication, reduce production costs and achieve personalized and humanized development.

“According to the history of industrial development, human society has successively experienced the ‘Industry 1.0’ era marked by steam engine technology, the ‘Industry 2.0’ era marked by electric power and internal combustion engine technology, and the ‘Industry 3.0’ era marked by electronic computer technology. The current “Industry

4.0” era is marked by intelligence, automation, and networking [1].” The first industrial revolution enabled the mechanization of processes, the second was the introduction of mass production of electricity based on the division of labor, the third was the automation of certain processes through a combination of electronic and computer power, and the fourth industrial revolution means that in the manufacturing process, machines and equipment can communicate with digital devices that are interconnected in the value chain [2].

2.2 The Characteristics and Impact of “Industry 4.0”

2.2.1 The Characteristics of “Industry 4.0”

“Industry 4.0” presents a booming trend of accelerated fission and subversion. Hu Quintai wrote in “The New Pattern of Smart Education in the Background of Industrial Revolution 4.0” that “Industry 4.0” has the performance of networking (interconnection), greening (energy saving), and intelligence (wisdom) [3].

Intelligent The so-called intelligence, “in the so-called intelligent [era of manufacturing, service industries and other industries to achieve intelligent production to replace traditional production era, can be seen from the perspective of the industrial revolution. From the perspective of society, not only Changes in production methods also involve changes in politics, economy, and culture [4].” In the “Industry 4.0” stage, cloud computing technology outputs new high-value information and produces more new products through massive data analysis, new services, and a high degree of informatization enabling production enterprises to produce on-demand and realize personalized customization. At the same time, cloud computing can improve the management efficiency of enterprises. By analyzing big data, it can help enterprises to identify their positions and formulate scientific and reasonable strategic plans so that enterprises can better adapt to the trend of the new era whether it is an internal operation or external expansion.

Interconnection “The Internet of Things is the Internet of things connected; there are two meanings here: on the one hand, the Internet is the core of the Internet of Things and the Foundation, and the Internet of Things is a network that expands and expands on the Internet; Expansion and use of information exchange and communication between projects and projects, therefore, the Internet of Things connects to the Internet through information sensing devices such as radio frequency identification (RFID), infrared sensors, global positioning systems, laser scanners, etc., according to agreed protocols, to exchange and connect information [5].” In the “Industry 4.0” stage, the number of devices connected to the Internet will increase exponentially in recent years, and companies can track the traces of products in the supply chain through sensor signals, including tracking their actual performance and usage. Enterprises can also realize remote monitoring of office processes and remote control of the office environment through information technology. It can be seen that the “connection of things” has become one of the most important features of the “Industry 4.0” stage.

Greening In the third industrial revolution, people realized the importance of the natural environment and began to find a balance between development and protection, but the

results were not very significant. In the “Industry 4.0” stage, “a large number of inventions and applications of ecological protection and sustainable development of science and technology during the scientific and technological revolution, as well as a large number of high-tech technologies applied to ecological protection and sustainable development. In the scientific and technological revolution, human society and nature achieve harmonious coexistence [6].” The proposal of the “green technology revolution” has given new possibilities to realize sustainable development at this stage.

2.2.2 The Impact of “Industry 4.0”

In June 2020, Yang Jie, chairman of China Mobile, pointed out that the digital transformation of the economy and society driven by “Industry 4.0” presents new characteristics: “five typical scenarios for the accelerated penetration of emerging digital technologies into the economy and society include infrastructure digitization, social governance digitization, and production methods. Digitization, digitization of work methods, and digitization of lifestyles; three common needs for the digital transformation of the economy and society have arisen, including online needs, intelligent needs, and cloud-based needs [7].”

At the same time, “Industry 4.0” has changed the social production mode, people’s employment methods, and government system in terms of social development. In terms of people’s future development, it has changed people’s way of life, solved many social problems, and promoted the all-around development of individuals. “Industry 4.0” makes real socialized production reality, and the free association of a single individual and social micro-organization has more sufficient conditions.

3 Corporate Sustainability

3.1 The Origin, Definition of Corporate Sustainability

“The concept of sustainable development first appeared in a report of the United Nations World Commission on Environment and Development entitled ‘Our Common Future’ in 1987, the ‘Rio de Janeiro Declaration’ and ‘Agenda 21’ adopted by the United Nations Conference on Environment and Development in 1992 when sustainable development was pushed from theory to action for the first time[8].” Sustainable development emphasizes development that meets the needs of the present without compromising the ability of future generations to meet their needs, requires us to invest in natural capital, and diverts a portion of economic resources from other uses to protect and improve the natural environment, emphasizes development quality and intergenerational equity.

After the idea of sustainable development was put forward, people gradually realized that the biggest threat to sustainable development is nothing but human economic activities. It is the operation of the entire economic system that has caused today’s serious environmental problems. Avoided has become the most important micro-subject in the sustainable development model. With the help of the idea of sustainable development, some scholars have introduced the research from macro to micro and put forward the concept of enterprise sustainable development from a new perspective.

Based on the existing research, it can be seen that the content of sustainable development of enterprises mainly focuses on two aspects: “one is the acquisition and maintenance of sustainable competitive advantages and sustainable profitability of enterprises in the competition, which is actually about the economic performance of the organization; The second is the ecological behavior of enterprises, that is, enterprises continue to improve resource utilization, pollution prevention, and ecological impact, and achieve the coordination and unity of economic, environmental and social benefits while pursuing economic interests[9].” We believe that the sustainable development of enterprises means that enterprises keep lasting competitive advantages and profitability in the competition, and realize the coordinated development of economic, environmental, and social benefits through the improvement of resource utilization and the strengthening of ecological efficiency.

3.2 Connotation of Corporate Sustainability

The sustainable development of enterprises is mainly affected by the internal and external aspects of enterprises: external factors such as government, regulations, market, and technology, and internal factors such as human resources, management ability, enterprise system, and innovation ability play a decisive role in the sustainable development of enterprises. “Most scholars agree to evaluate the sustainable development ability of enterprises from six indicators: finance, management ability, decision-making level, corporate culture, marketing, and political and economic situation [10], [12].” Wu Yanli and other scholars constructed “the sustainable development capacity system of small and medium-sized enterprises by building the ability of small and medium-sized enterprises to bear social responsibility, forming resource integration ability, developing learning ability, improving adaptability and developing innovation ability [11].” Enterprises should improve their core competitiveness by creating a high-quality environment for sustainable development, establishing strategic thinking, constantly carrying out technological innovation, improving the quality of employees, building enterprise culture, and implementing brand strategic management. At the same time, we should pay attention to effective talent strategic management and financial strategic management.

3.2.1 Economic Sustainable Development

The economic activities of enterprises should be profitable and sustainable for a long time. Sustainable economic development refers to the gradual and stable improvement of the gross domestic product and production level of enterprises, which is always steadily higher than the historical level.

3.2.2 Social Sustainable Development

Socially sustainable development mainly emphasizes the development of social benefits, which requires enterprises to pay attention not only to economic interests but also to the protection of the natural environment and contribution to society. While developing themselves, enterprises should take into account the interests of future generations and the common development of the whole society, and make their due contributions to

the sustainable development of society, such as actively fulfilling social responsibilities, providing high-quality products, actively participating in charitable activities, etc.

3.2.3 Environmental Sustainable Development

Enterprises have a certain impact on the ecosystem in their operation and development, and a good natural environment can provide a good working environment for the production activities of enterprises. To realize the sustainable development of the ecological environment, enterprises must develop and exploit in moderation, and protect and utilize natural resources appropriately. Enterprise ecological sustainable development emphasizes that enterprises should have low consumption, high efficiency, high resource utilization rate, and comprehensive utilization of resources. Therefore, enterprises should make contributions to ecologically sustainable development through their internal integration, science and technology, and high requirements.

4 Digital Leadership

From the end of the 20th century to the beginning of the 21st century, with the sweeping of Internet technology and communication technology, the workplace has fully entered the era of information or electronic office. In recent years, “with the wide application of emerging digital technologies represented by 5g, block-chain, Internet of things, cloud computing, big data and artificial intelligence [17],” we have ushered in the digital era. Emerging digital technologies and the social economy are continuously and deeply integrated, which makes great changes in leadership, so “digital leadership” came into being.

Avolio and Kahai believe that “digital leadership” is a process in which leaders’ emotion and behavior change and affect organizational performance when information technology is embedded in the context of organizational management [13, 14].” Based on the discussion of Avolio, some scholars have studied the empirical level of digital leadership. For example, Roman and others believe that “digital leadership is a process of social influence. The exertion of influence not only requires the exertion of leaders’ characteristics such as communication, motivation, and management, but also requires leaders’ perception, understanding, and integration into the information technology environment [15, 16].” Therefore, this study believes that “digital leadership” refers to the process in which leaders use digital technology to realize the transformation of individual emotion and behavior, and give full play to the characteristics of communication, incentive, and management, to have an impact on the motivation, behavior, culture, and environment of the organization, and finally maximize the benefits of the organization.

5 The Effect of Digital Leadership on the Corporate Sustainability

5.1 Cognition-Corporate Philosophy

Leaders grasp the direction of enterprise development, and their cognition has a profound impact on the overall cognition of the enterprise. Digital leadership promotes enterprises to build a digital thinking framework, have digital strategic ideas, and formulate enterprise systems suitable for the background of digital transformation.

After having digital cognition, enterprises can more comprehensively consider the relationship between the whole and themselves in terms of development concept and development system. First of all, enterprises will rethink the industry layout, quantify thinking, pay attention to facts, and pursue truth from the perspective of digitization. Enterprises will use digital technology to reconstruct themselves, abandon the extensive marketing concept of stimulating consumption and pursuing the increase of consumption, and use cloud computing and other information technologies to improve supply efficiency and quality. Enterprises will also choose to provide high-quality services and products that better meet the real needs of consumers, and establish a strong customer base and employee values that conform to the trend. The sustainable development of sales and consumption will drive the sustainable development of enterprises.

Secondly, enterprises will carefully consider the relationship between short-term and local interests and long-term and overall interests from the perspective of digital development. Enterprises use digital technology to accurately predict the impact and benefits of a certain stage, strategy, and activity on the economy, society, and environment, and then adjust the corresponding actions according to the results shown in the data model to flexibly balance the relationship between corporate social responsibility and economic profit.

Finally, enterprises will judge their future development more accurately than traditional forecasts from a digital perspective. Digital leaders will use information technology to formulate appropriate strategic plans for pricing, marketing, finance, and talent after analyzing the competitive landscape and future competitors of enterprises.

5.2 Action-Corporate Management

5.2.1 The Supportive Behavior of Digital Leadership on Enterprise Management

Efficient Information Communication Digital leaders are proficient in using communication technology and digital technology to upload and release information and data. The improvement of digital leadership can not only improve the accuracy, timeliness, and confidentiality of information communication within the enterprise but also achieve consistency within departments and synergy between departments. Consensus enables corporate members to understand and follow the pace of corporate development better than under traditional leadership, greatly reducing resistance to corporate decision-making and implementation.

Efficient Team Building Digital leaders are skilled in using communication technology, digital technology to build, motivate, and maintain the ability of digital high-efficiency teams. After analyzing the company's strengths and weaknesses, digital leaders will use visual data to conduct a detailed analysis of the company's team capabilities, to tap the team's potential and sustainable development capabilities in a targeted manner.

Efficient Organizational Operation Digital leaders are skilled in using communication technology and digital technology to improve management efficiency, improve work patterns, and improve production technology. Digital leaders use digital technology to break the original work mode, improve the operational efficiency of the organization,

innovate the organizational structure, and promote the diversified development of the organization. At the same time, it can evaluate the benefits brought by adding or reducing a certain department in the enterprise. For example, by analyzing the addition of environmental departments in energy companies, digital leaders can use information technology to evaluate the economic benefits and economic costs brought about by them, to enable enterprises to balance society, environmental benefits while maximizing profits.

5.2.2 The Control Behavior of Digital Leadership on Enterprise Management

Digital leaders can use digital technology to monitor the operation of the enterprise in real-time, observe the internal situation of the enterprise, grasp the progress of work tasks, and track the flow of personnel and products. For example, establish a personnel information database in the human resources management department to master the work results, promotion, transfer, training, and learning of employees, and realize one-click evaluation and one-click matching.

5.2.3 The Feedback Behavior of Digital Leadership on Enterprise Management

One of the important aspects of digital leadership that is different from traditional leadership is the way leaders give feedback to employees, which is changing from offline to online. Although it seems that the way of online feedback makes people farther apart, the network's characteristics of anonymity, dissemination, and publicity make the feedback behavior of digital leaders fairer, humanized, and interactive. Employees can express their demands more fearlessly, and digital leaders can have a direct dialogue with employees. Both positive and negative feedback can be conveyed more directly than through traditional leadership methods. When employees can often receive feedback directly from the leader and their reasonable needs are met, it will increase the recognition and trust of the leader. Therefore, the improvement of digital leadership is also conducive to improving the credibility of business leaders and improving the loyalty of employees.

5.3 Culture-Corporate Culture

Corporate culture means the spiritual atmosphere of the enterprise, and establishing an innovative and sustainable cultural and spiritual atmosphere is conducive to the rapid development of the enterprise.

First of all, the innovation team has a strong fit with digital technology. Digital technology itself is a kind of innovation, which has the characteristics of transcending time and space. The innovative thinking and the emergence of innovative ideas of team members are irregular, and digital leadership can guide the realization of enterprises. Communication between employees at any time ensures the immediacy of innovation exchanges, thereby enhancing their enthusiasm for innovation.

Secondly, the formation of internal corporate culture is based on the diversity of members' cultural backgrounds. Digital leadership is conducive to breaking through the limitations of time and space to absorb more members with multi-ethnic and multi-regional cultural backgrounds and more members with digital cultural backgrounds.

This is conducive to enriching the member structure of the enterprise, realizing the blending of cultures, developing the thinking of employees, and innovating service and product supply. In addition, attracting multiple members will help enterprises to explore consumer needs more comprehensively, improve the social adaptability of enterprises, and achieve sustainable development.

Finally, through real-time control and detection, digital leadership can reduce the behavior that damages the reputation of the enterprise caused by management negligence to a certain extent, and a certain extent, promote the enterprise to undertake certain social responsibilities, form a noble corporate culture, and establish a good corporate image.

5.4 Environment-Corporate Environment

The enterprise environment includes the internal environment of the organization and the external environment. Big data, blockchain, and other technologies can improve the team's data analysis capabilities and speed. Digital leaders' proficiency in such technologies will help them better understand the financial status of the company, development stages, and other internal information as well as industry, society, etc. external information. Only on the premise of a clear, accurate, and timely understanding of the self and the external situation can a digital transformation strategy be better formulated, and a development plan adapted to its human, material, and financial resources can be formulated. Under the dual background of "Industry 4.0" digital transformation and the outbreak of the new crown epidemic, the development of enterprises faces more opportunities and challenges. Only enterprise managers with digital leadership can lead enterprises to see the current situation, find a breakthrough, and embark on the right and sustainable direction.

6 Conclusion

Through the above analysis, we can find that digital leadership promotes the digital transformation of enterprises by affecting enterprise philosophy, enterprise management, enterprise culture, and enterprise environment, and helps enterprises achieve sustainable economic, social, and environmental development under the background of "Industry 4.0".

References

1. W.B.Li, Research on the essence and influence of industrial revolution 4.0, China University of mining and technology, 2019.
2. Y.X. Zhang, Overview of industrial 4.0 development research, in: Modern industrial economy and informatization, 2022, pp. 20–21,34. DOI: <https://doi.org/10.16525/j.cnki.14-1362/n.2022.01.007>.
3. Q.T. Hu, L.Q. Liu, K. Zheng, New pattern of wisdom education under the background of industrial revolution 4.0, in: China Educational Technology, 2019, pp. 1–8. DOI: <https://doi.org/10.3969/j.issn.1006-9860.2019.03.001>.
4. J. Wu, Intelligent era: big data and intelligent revolution redefine the future, in: L.Yu Technology, 2017, p. 4. DOI: CNKI:SUN: YSKI.0.2017-01-037

5. [5]N.R. Augustine, Rising above the gathering storm: energizing and employing America for a brighter economic future, in: Research technology management, 2007. DOI: <https://doi.org/10.17226/11463>
6. X.H. Yan, Philosophical Thinking on “industry 4.0” technological revolution, in: Anhui: Hefei University of Technology, 2017. DOI: <https://doi.org/10.7666/d.Y3294493>.
7. P. Fan, The fourth industrial revolution brought profound changes to the world, in: People’s Forum, 2021, pp. 41–45. DOI: <https://doi.org/10.3969/j.issn.1004-3381.2021.05.010>.
8. B.C. Liu, T.P. Jiang, Analysis of factors affecting sustainable development of enterprises, in: Decision reference, 2000, pp. 2–5. DOI: <https://doi.org/10.3969/j.issn.1672-0334.2000.04.001>.
9. S. Hu, Sustainable development of enterprises from the perspective of ecology, in: Gansu Social Sciences, 2004, pp. 232–235. DOI: <https://doi.org/10.3969/j.issn.1003-3637.2004.06.067>.
10. H.Q. Yu, Research on a fuzzy comprehensive evaluation of sustainable development ability of small and medium-sized enterprises, in: Enterprise economy, 2010, pp. 22–24. DOI: CNKI:SUN: QUIT.0.2010-04-007
11. Y.L. Wu, L.F. Chen, On the construction of sustainable development capability system of small and medium-sized enterprises, in: Journal of Harbin University of Commerce, 2008, pp. 24–26. DOI: <https://doi.org/10.3969/j.issn.1671-7112.2008.02.007>
12. X.H. Zhang, A summary of research on sustainable development of small and medium-sized enterprises, in: Chinese business theory, 2018, pp. 85–86. DOI: <https://doi.org/10.3969/j.issn.1005-5800.2018.01.042>.
13. Bruce, et al, G.E. Dodge, E-leadership: Implications for theory, Research and Practice, in: The Leadership Quarterly, 2000, pp. 615–668. DOI: [https://doi.org/10.1016/S1048-9843\(00\)00062-X](https://doi.org/10.1016/S1048-9843(00)00062-X)
14. S.S. Kahai, J.J. Sosik, B.J. Avolio, Effects of Participative and Directive Leadership in Electronic Groups, in: Group and Organization Management An International Journal, 2004, pp. 67–105. DOI: 67–105. <https://doi.org/10.1177/1059601103252100>
15. A.V. Roman, M.V. Wart, X.H. Wang, Defining E-leadership as Competence in ICT-Mediated Communications: An Exploratory Assessment, in: Public Administration Review, 2018, pp. 853–866. DOI: <https://doi.org/10.1111/puar.12980>
16. Y.P. Ju, Digital leadership matrix analysis and promotion path research in the digital age, in: Leadership Science, 2021, pp. 47–50. DOI: <https://doi.org/10.3969/j.issn.1003-2606.2021.08.014>.
17. [17]L. Miao, Research on enterprise digital leadership structure and its influence mechanism on organizational innovation behavior, Hubei: Wuhan University, 2020.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter’s Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter’s Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

