

Review

# How does digital transformation influence green governance? A synthesis of the literature

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**Abstract: Propose:** This paper focuses on helping companies solve the pressure brought by the current digital trend and environmental ecological challenges and achieve the strategic goal of sustainable development. **Methods:** In this paper, the literature review method is used to collect the relevant literature of the Web of Science (WOS) database 2014–2015 and explore the natural advantages of digital transformation (DT) in the field of green governance. In addition, VOSviewer is used for literature metrology to generate a visual map in order to visually present the current research hotspots. **Results:** This study shows that DT has three advantages in the field of green governance. Firstly, DT can significantly affect green governance. Secondly, DT can significantly affect green innovation. Thirdly, DT can significantly affect Environment, Social, and Governance (ESG) performance. **Practical implications:** This study reviews the relevant literature on DT and green governance and excavates the influence of DT in the field of green governance. On the one hand, this study enriches the dual research perspectives of DT and green governance, fills the gap in the study of DT green governance and the level of new green governance, and has important theoretical significance. On the other hand, it is of great practical significance to explore the impact of DT on green governance and provide an important reference for companies to build a new governance paradigm in the digital era.

**Keywords:** digital transformation; green governance; corporate

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## 1. Introduction

Digital transformation (DT) is the key for companies to gain dividends and achieve sustainable development. With the rapid development of the digital economy, digitalization has gradually evolved into an important trend of The Times. In order to seek long-term development, the strategic decision of DT has been adopted by enterprises to enhance productivity [1,2] to follow this trend [3]. DT has been regarded as an important strategic decision to mitigate the transformation of modern enterprise management and information systems, which has attracted wide attention from the international community [1]. In the meantime, the potential overall risk posed by global climate change is a serious challenge to the long-term development of enterprises. With the help of digital technology, such as big data technology and artificial intelligence technology, the company carries out green activities to achieve efficient operation and timely feedback [4], which is conducive to better response to the challenges of the ecological environment. By utilizing the advanced digital technology to collect, store, and analyze data, DT could enhance the corporate green governance effect from multiple dimensions and provide technical support for the

sustainable development of the company. From one perspective, the DT strategy could promote cross-regional and cross-domain technology innovation and technology utilization, which improves the ability of the company to absorb, re-develop, and update the technology and knowledge. From another perspective, the feasibility of emissions monitoring and carbon footprint tracking in the field of green governance could be greatly improved through the utilization of industrial data modeling and artificial intelligence analysis in the management phase. Digital technology could be used as an important means of energy conservation initiatives to strengthen the systematic management of the whole life cycle of the company and prepare for the green governance of the company. However, the long-term investment of a large number of resources is required by digital transformation, and the initial investment does not pay off in a short period of time, which could lead to resource scale effects and increase financial risk [5]. Therefore, corporate green governance can be influenced positively by digital transformation, which is an important way to achieve sustainable development and enhance the core competitiveness of enterprises [6]. However, due to the limitations of the DT itself, which requires the company executives to adjust in the management activities and finally make the DT play a positive role.

The existing literature on the impact of DT in the field of corporate governance is relatively comprehensive, which could be roughly divided into internal strategic choices, such as tax research [7], corporate restructuring [8], and strategic decision-making [9]. and external factors of the company, such as business risk [10] and social responsibility [11]. As for the performance level of enterprises, most studies focus on the sustainability of enterprise development and study the impact of DT on environmental performance [12,13] or ESG performance [14,15]. In terms of the selection of research samples, a large number of literatures focus more on selecting Chinese companies as research objects [16,17] to analyze the influence mechanism of DT.

The contribution of this study is as follows: on the one hand, it enriches the perspective of related research of DT and provides relevant reference for companies to implement digital transformation. This paper discusses the DT of enterprises from the perspective of comprehensive development such as social responsibility and corporate governance, which helps to further clarify the importance of DT in the operation process of enterprises and provides theoretical support for enterprises to promote DT reasonably. This study explores the specific impact path of DT on green governance by tapping the natural advantages of digital transformation. The influence of DT on green governance was summarized by a literature review. On the other hand, it deepens the relevant research on the influencing factors of green governance and provides reference for the construction of the green governance paradigm of companies in the new era. DT is an important way for companies to adapt to the development of the digital era and master key resources, providing new ideas for companies to achieve sustainable development and improve the effect of green governance. At the same time, it enriches the research methods of literature review. Based on a large number of sample data in the WOS database, VOSviewer was used to summarize large-scale data [18], and literature metrology visualization was carried

out, providing a new perspective for research in this field. In addition, this study provides an important reference for the company to build a new paradigm of green governance in the digital era, which helps the company to alleviate the dual pressure of the digital trend and environmental and ecological challenges and has important practical significance.

## **2. Methodology**

In order to realize the purpose of this study, the relevant database is extended to improve the universality and relevance of this paper. The WOS database is utilized in this paper, the key words of which are set as “digital transformation and green”, and the publication time of relevant literature is defined as 2014–2023. The research area is business economics. A total of 128 papers are found to be highly relevant to this study.

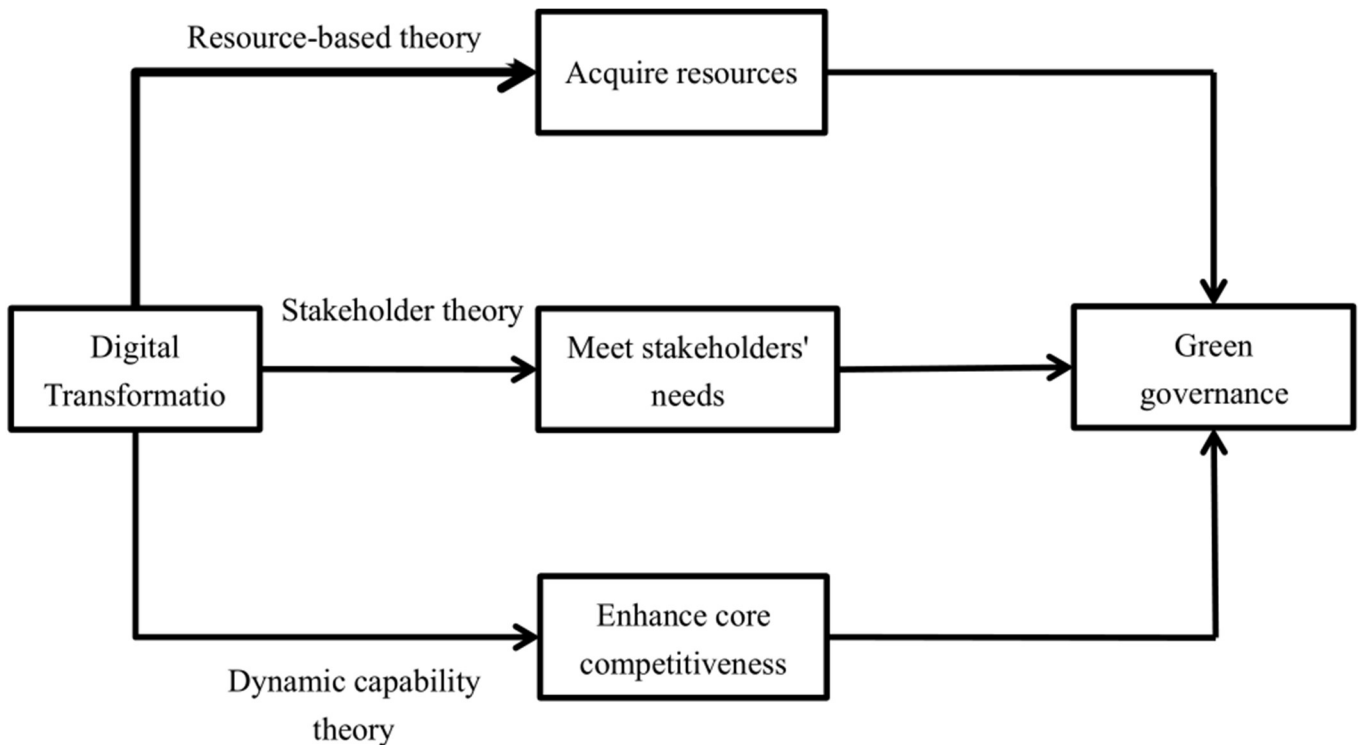
Through bibliometric analysis, this paper can better evaluate the relevant literature and draw common conclusions. This approach is not only beneficial for data processing but also has a positive impact on academic output [19]. In terms of research methods, this paper uses VOSviewer to dig the internal relations between literatures related to this topic in recent ten years, generate bibliometric maps, and conduct bibliometric analysis for the purpose of highlighting the research trends on the topic of “digital transformation and green” from 2014 to 2023 (on 282 papers from the WOS database).

As an important database for global access to academic information, the WOS database involves information in the fields of natural sciences, social sciences, arts, and humanities and includes nearly 9000 of the most prestigious high-impact research journals from around the world. It is of great significance to take the relevant literature collected by WOS as samples for research and analysis.

This study adopts the literature review method, which can help company executives understand the specific impact mechanism and path of DT on green governance, such as mastering and applying the advantages of digital transformation, actively playing the functions of digital technology, and preparing for the current digital trend. At the same time, this study can provide specific focus points for corporate executives to implement green governance strategies, including improving the level of green innovation, assuming social responsibility, improving ESG performance, etc. Among them, ESG performance is the key factor to determine the effect of corporate green governance, which deserves the attention of corporate executives. Therefore, this study has important commercial and social value.

## **3. Theoretical framework**

In the existing literature, a large number of theories are used to analyze and study the relationship between DT and green governance, among which resource-based theory, stakeholder theory, and dynamic capability theory are the most frequently used theories. The above theories also provide a theoretical basis for DT to exert its unique advantages in the field of green governance. Details are shown in **Figure 1**.



**Figure 1.** Influence mechanism of DT on green governance.

### 3.1. Resource-based theory

According to the resource-based theory, the core competence of an enterprise is determined by the heterogeneous resources possessed by the enterprise. DT is a key means for companies to make full use of the heterogeneous resources of data elements to create competitive advantages for the sustainable development of the company [20,21]. On the one hand, more favorable information resources are provided to enterprises with the support of DT [22]. With the help of digital technology, companies can accelerate the speed of information transmission and promote internal information exchange and sharing [23], which is conducive to breaking the “digital gap” in internal management of enterprises and strengthening communication and cooperation between departments. Ultimately, the efficiency of resource circulation and allocation can be improved, and the stability of financial resources of enterprises can be enhanced [24]. In addition, DT can also provide sufficient information support for the operation, management, and strategic decision-making of enterprises. In addition, digital transformation can help promote the positive impact of enterprises on the environment, improve resource utilization, and build a more environmentally friendly circular economy development model [25,26].

On the other hand, under the current situation that national policies constantly emphasize innovation-driven and sustainable development, the cost of collecting and analyzing environmental information for enterprises could be reduced by digital transformation, so that the change direction of the latest environmental policies and market dynamics could be quickly grasped by enterprises, and more preferential government policies could be obtained by enterprises [27], such as sufficient financial support, financing loans, which is beneficial to reduce the financing difficulty of R&D

activities in the field of green governance. Moreover, company executives can accurately understand customer needs through the implementation of DT [28] and timely adjust green business strategies, which will reduce production costs and improve productivity of enterprises. In summary, according to the resource-based theory, DT can create competitive advantages for companies and improve the level of corporate risk taking and the effect of green governance [29].

### **3.2. Dynamic capability theory**

Dynamic capability refers to the ability of an organization to create, adjust, and expand competitive advantages for specific purposes [30]. Dynamic capabilities can help companies quickly adapt to complex and changing environmental situations of distance column changes and make dynamic adjustments [31]. When it comes to scaling up operations, dynamic capabilities can create and maintain significant advantages over other competitors [30]. Therefore, dynamic capability plays a positive role in the business development of enterprises in the rapidly changing environment [32].

Research shows that dynamic capabilities play a crucial role in the DT of enterprises [33]. DT is not simply digitization based on existing capabilities [34]. Enterprises need to make full use of existing capabilities while constantly exploring new capabilities in the process of business development, such as using perception capabilities to uncover opportunities and challenges in the internal management and external competitive environment of the company [35], so as to maintain dynamic innovation capabilities and competitiveness, which is conducive to the DT of the company. As for the solution of maintaining dynamic capability, company executives need to maintain keen judgment and innovation awareness in a complex and changing competitive environment, promote green innovation by increasing R&D investment [36], so as to gain competitive advantages in green products and services, and ultimately further enhance the effect of green governance.

Relevant research on dynamic capability theory is mainly divided into three aspects, namely basic theory, process theory, and hierarchy theory, among which the basic theory is the most widely used [37]. The influence of DT on corporate green governance can be explored based on the internal relationship between dynamic capability theory and corporate sustainable development strategy. Dynamic capability can be divided into green innovation capability and social responsibility capability, thus enriching the basic components of dynamic capability theory [38]. Energy conservation and emission reduction are advocated by green innovation, which provides environmental and social benefits [39]. Social responsibility refers to a company's ability to continuously improve and optimize its digital infrastructure based on customer feedback to meet the interests of all parties. Actively fulfilling social responsibility is conducive to improving the reputation and image of the company, thus enhancing the value of the brand [40].

### **3.3. Stakeholder theory**

According to stakeholder theory, enterprises should take into account the interests of internal and external stakeholders and be responsible to all stakeholders, including

shareholders. Stakeholder theory has been used by more and more existing literature to explore the effect of corporate green governance. On the one hand, there is a correlation between green governance and corporate financial performance. Constantinescu et al. [41] found that the ESG disclosure is positively correlated with the value of the company. A higher degree of ESG disclosure contributes to the enhancement and improvement of corporate transparency and financial performance [42,43], which is conducive to improving the degree of trust of shareholders and stakeholders. Lys et al. [44] found that positive signals about future financial performance can be released by corporate social responsibility reporting. On the other side, green governance cannot be separated from the fulfillment of social responsibilities. Stakeholder satisfaction can be improved by the high expenditure of enterprises on social responsibility [45]. The article by Matute-Vallejo et al. [46] provides further supporting evidence for the impact of CSR on the relationship with customers. And Nugroho et al. [47] put more emphasis on the impact of ESG and social responsibility on consumers. Empirical research finds that ESG performance has a positive effect on corporate social responsibility measures, which helps to enhance brand value and give consumers sufficient confidence. The influence of DT in the field of corporate green governance should not be underestimated. On the basis of meeting the needs of stakeholders, including external investors, consumers, and internal shareholders, the governance effect of DT can improve the quality of ESG information disclosure and the ESG performance of corporations. In addition, company managers are encouraged by DT to assume social responsibility. Wang et al. [48] believe that DT has a positive effect on the ESG responsibility performance of corporates, which can enhance information transparency and investor stickiness.

## **4. Results and discussion**

### **4.1. More and more scholars participate in exploring green governance**

The connections between DT and green governance have been found in the literature since 2015 until 2023.

**Figure 2** gives a holistic overview of the past research based on keywords' cooccurrences with 'digital transformation and green'. The analysis reveals a discernible prominence reflecting four principal domains of investigation, namely three significant clusters that can be identified based on visualization in **Figure 2A**, such as a) DT (digital transformation), b) sustainable development, c) green, and d) green innovation. Many researchers [1,49–53] have recently focused on studies such as circular economy, green innovation, artificial intelligence, firm performance, social responsibility, etc. (**Figure 2B** bottom). Thus, it can be seen that the existing literature on DT and green field research is more comprehensive, and its view of research is also different.



## **4.2. Corporate green governance**

Green governance covers a wide range of subjects, involving the state, public sector, enterprises, society, and other organizations [54,55]. Scholars have studied green governance in a more comprehensive way, and its influence mechanism will spread to economic, political, legal, and other fields [56,57]. In addition, as an important part of green governance, corporate governance focuses more on operation and management at the company level, including external environmental pressure, such as supervision of public media, environmental regulation, etc. [58,59], and adjustment at the detailed level of internal governance, such as increasing R&D investment, improving ESG performance, etc. [60,61]. Among them, ESG performance is the key factor to quantify the effect of corporate green governance [62,63]. Green innovation is an important field of green governance, which attaches importance to energy conservation, emission reduction, and ecological environment protection and is a vivid manifestation of the effect of green governance [50,51]. Therefore, to explore the effect of green governance at the corporate level, we should pay attention to the green innovation and ESG performance of the company.

In Pane's view [64], corporate green governance refers to the organic combination of organizational development goals and environmental goals and the realization of sustainable development goals through innovative technologies, methods, and models. Existing studies have conducted extensive discussions and explorations on how to strengthen corporate green governance, which could be roughly divided into three approaches: strengthening the environment-oriented corporate operation effect, meeting the green value needs of stakeholders, and using digital intelligent technology.

Based on the environmentally oriented perspective of corporate operations, existing studies indicate that green governance could be enhanced by green cognition and the implementation of green innovation [65]. On the one hand, green governance could be positively influenced by the promotion of green cognition and consciousness. Potential opportunities in competitive markets could be grasped by corporate executives with high environmental awareness [32], who incorporate the improvement of environmental performance into the strategic objectives of the company and direct the company to apply existing resources to green governance activities to achieve sustainable development goals [66]. On the other hand, the positive effects of green innovation cannot be ignored. It is found that green innovation plays a significant positive role in the operation of energy enterprises, especially in the aspect of carbon emission reduction [67]. The effective improvement of environmental performance and corporate green governance effects can be achieved through the recognition and action of green innovations, such as the use of carbon capture methods and the improvement of the cleanliness of production processes.

As for meeting the green value needs of stakeholders, some scholars believe that relevant initiatives from stakeholders, such as the government, green investors, the public, and the media, have a significant impact on the effect of corporate green governance. The proactive disclosure of environmental information by enterprises is influenced by the environmental regulatory policies introduced by the government



[68], which could reduce environmental management risks, improve environmental performance through point-to-point monitoring, and promote corporate green governance. There are some differences and synergies between the public and the media on corporate green governance [69]. According to Chi and Yang [70], both public demand for the public environment and relevant media reports promote the effect of corporate green governance.

From the perspective of digitization and intelligence, digital technology can be used as an adjunct to business decisions. Guo et al. [71] believe that the establishment and improvement of digital infrastructure is conducive to the “paperless” online work of enterprises, the reduction of resource consumption, and the green transformation of enterprises. According to Shen and Zhang [72], the technological advantages brought by the development of artificial intelligence provide a new paradigm for enterprises to achieve green governance. The implementation of intelligent governance could reduce the pollution emission intensity of enterprises and strengthen the effect of green governance through the artificial intelligence technology.

### **4.3. Advantages of digital transformation**

#### **4.3.1. DT can significantly affect corporate green governance**

Enterprises are urged to complete DT as soon as possible to achieve sustainable development because of the rapid development of the digital economy. In the process of digital transformation, new logic and ideas are generated [73], and this methodology is used to create and acquire enterprise value, which becomes an important way to establish a new business model [74].

On the one hand, the profound impact of DT on enterprises has been tested in practice [34]. Firstly, communication and transaction costs can be effectively reduced by DT [75], and the transparency of market information [76] can be improved. Company executives can more efficiently monitor the dynamic changes of the market and the needs of customers so as to adjust the corporate governance path to adapt to the changing market environment and improve the business performance of enterprises [77]. Secondly, DT could help enterprises adapt to the external complex and changeable competitive environment [77,78]. With the help of digital technologies, including big data, artificial intelligence, cloud computing, etc. [30], company executives can build new modes of internal communication, such as human-machine communication [52], which will not only promote the company’s innovation [79], but also promote the company’s innovation. It also helps to enhance the company’s sustainable development ability [80]. Thirdly, DT provides enterprises with international competitive advantages [81]. By changing the corporate governance structure and adjusting the business model, DT could improve the business acumen and decision-making ability of the company’s executives. Scientific business decisions could be decided by senior executives with the combination of relevant information about strategic decisions and analysis of current situation changes, thus enabling enterprises to gain advantages in the complex and changeable international competitive environment [82].

On the other hand, with the advancement of digital transformation, the connection strength within the company and between upstream and downstream partners has been

further enhanced, and key resources such as information and technology have gradually accumulated, which is conducive to improving technological innovation, strengthening the correlation and collaboration in the supply chain, and making the green activities more transparent and efficient. Hence, the green governance of the company could be promoted [83]. DT enhances the strength of corporate partnerships, which in turn strengthens corporate green governance. In order to promote digital transformation, companies can realize the full exchange and sharing of information, technology, and other resources in the supply chain by establishing intelligent integrated systems, the Internet of Things, and other digital intelligent platforms, and improve the allocation efficiency [84]. In addition, the advantages of DT in information exchange and resource sharing have stimulated downstream greening demand and promoted upstream green governance. Furthermore, upstream enterprises carry out green governance by means of equipment upgrading and reducing pollutant emissions [85], which also improves the production process standards of downstream enterprises. Upstream and downstream enterprises influence each other, forming a virtuous circle, thus enhancing the green governance effect of the entire supply chain.

#### **4.3.2. DT can significantly affect green innovation**

As an important means for companies to achieve sustainable development, DT has significantly influenced green governance through technologies such as digitalization, the Internet, and big data. Especially in the field of green innovation, the impact of DT is particularly significant. On the one hand, the integration and allocation of R&D resources can be optimized by digital technologies, thus improving the innovation vitality of enterprises [86] and promoting the green innovation of enterprises [29]. Based on a survey of 215 enterprises, El-Kassar and Singh [87] found that digitalization has a positive effect on the activity of green innovation and helps enterprises gain competitive advantages. Specifically, the ability of product development and innovation of enterprises can be promoted by DT to improve the green governance of enterprises. Based on cutting-edge digital technology, enterprises can shorten the research and development cycle, reduce the research and development cost of green products, accelerate the development progress of green differentiated products [88], and improve the efficiency of green innovation. At the same time, the company is driven by the DT to carry out research and development activities with universities and research institutes in order to integrate the large number of resources needed in the field of green innovation, master the core technology and future development trend, and provide technical support for the green governance [89]. On the other hand, it cannot be ignored that the Internet and big data technology have an impact on green innovation. In the manufacturing sector, big data analytics technology can be applied to develop optimal solutions for environmental issues, thus achieving the protection of the natural environment and the effective development of natural resources and ultimately promoting green innovation [90]. Moreover, existing studies have analyzed the mechanism of the Internet's influence on green innovation. The results indicate that the development of the Internet can provide new impetus for enterprise innovation and promote green innovation [91].

The existing literature studies on DT and the impact of digital technology on

green innovation are relatively comprehensive, but there are still some shortcomings. First of all, scholars usually pay more attention to the characteristics of DT itself, including concept definition and classification [92,93] and its own economic effects [53,94], paying less attention to the impact mechanism of DT on green innovation, which needs further research. Secondly, when exploring the impact of DT on green innovation, scholars are more inclined to measure from a single dimension such as digital technology and big data technology, which has a certain one-sidedness. The existing literature lacks a macro perspective to systematically analyze the impact of DT on green innovation.

#### **4.3.3. DT can significantly affect ESG performance**

The improvement of corporate ESG performance is one of the key driving forces to achieve the goal of economic and social green development [95]. With the improvement of the ESG evaluation system, ESG performance has gradually become an important embodiment of the social benefits achieved by enterprises and an important basis for measuring the effect of corporate green governance [96].

DT can improve ESG performance through digital-driven effects [37]. First, digital technology has the characteristics of environmental protection and energy saving, which can provide technical support for the company's green development [97]. On the one hand, the company can follow the road of fiscal and tax digital transformation implemented by the state and promote the green development of the company through green technology innovation [98]. On the other hand, DT can help company executives achieve the best possible personnel matching situation, thereby reducing resource losses and improving operational efficiency. Secondly, DT can encourage companies to value the quality of products and services and take on greater social responsibility [99]. Enterprises are able to obtain timely customer feedback by utilizing digital technology, thereby continuously improving their products and services and increasing user satisfaction [100]. In addition, DT helps to improve the market image and reputation of enterprises. More emphasis is put on maintaining its own good image, and finally it forms a virtuous circle.

At the specific impact path level, DT can improve the ESG performance of enterprises through dynamic capabilities such as green innovation and social responsibility. On the one hand, DT can promote enterprises to engage in green innovation activities so as to maintain certain competitive advantages [49]. First of all, DT can improve the company's awareness of green innovation, promote the development and application of new technologies, including green production, energy conservation, and emission reduction, and further improve the efficiency of green innovation [101]. Secondly, DT is conducive to the sharing of resources among various departments within the company, the development of the company's technical resources, and the construction of a new knowledge system. Various technology R&D is optimized and upgraded through DT, thus promoting green collaborative innovation within enterprises [102]. Thirdly, digital technology can effectively assist company executives to monitor all processes and links of the company's production management, grasp resource consumption and environmental protection, and achieve green process innovation [103]. The company's green innovation ability and ESG

performance are improved on the basis of DT.

On the other hand, enterprises can better fulfill social responsibilities and achieve sustainable development with the support of DT [104]. In the digital age, where companies and society are more closely connected, DT can help companies create a culture where business growth and external environmental pressures coexist. The external environmental pressures of enterprises, including environmental regulations and stakeholders' interest demands, urge companies to fulfill their social responsibilities with higher standards and disclose high-quality ESG information. Through the implementation of digital transformation, stakeholders' participation in social sustainable development can be increased, and the effectiveness of green activities can be objectively evaluated and quantified, thus helping to build a new model of coexistence between enterprises and the external environment, achieving mutual benefit and improving ESG performance [105]. Furthermore, DT is conducive to the improvement of the relationship between companies and consumers. Through the implementation of DT, enterprises can convey brand story and corporate mission to consumers by establishing accounts on social media platforms, developing apps, etc., and providing consumers with high-quality services [106].

#### **4.4. Some critics and arguments**

Although in the field of green governance, the impact of DT has been valued by scholars and has been applied in practice, there are still some scholars who hold different views on the correlation between DT and green governance. Some argue that DT has its own inherent limitations. She and Zhang [107] believe that DT is a kind of change activity that is active at all levels of the company and leads the change from top to bottom. Specifically, DT promotes the overall optimization and upgrading of specific organizational structures through the use of advanced digital technologies to facilitate disruptive changes to existing parts of the organization. Therefore, companies must invest significant resources to successfully implement DT [108]. Existing studies have conducted a comprehensive analysis on the driving factors of digital transformation and found that there are two levels that provide impetus for companies' digital transformation, including the external environment of enterprises, such as the market economy environment (Yang et al., 2021), tax incentives [109], and the market economy [110]. Open data access rights [111], industry competition [112], national financial subsidies [113], and the internal management of enterprises, such as financial performance [114], heterogeneity of institutional investors [105], and internal asset allocation [115]. The inherent limitations of DT have been mitigated by this series of studies but have been unable to break through and overcome.

Other critical viewpoints offer different views on the advantages of DT in the field of green governance. Scholars believe that the impact of DT on green innovation is not significant; however, green innovation has a more positive impact on DT due to its unique advantages. On the one hand, the same characteristics are shared by both green innovation and traditional innovation, such as the creation of new technologies and new products to help enterprises obtain new resources in the market and break through the inherent resource limitations of enterprises [72]. On the other hand, the advantages and characteristics that traditional innovation does not have are possessed

by green innovation. As an innovative activity, green innovation can profoundly change the formation and development process of technologies and products and ultimately achieve the goal of improving environmental benefits [116]. Therefore, the core of green innovation lies in sustainable value creation, which is conducive to realizing the sustainable business development strategy of the company [117]. Additionally, the characteristic of green innovation is to advocate energy conservation and emission reduction [118] and production cost reduction [119], which not only helps to improve the efficiency of the company's resource allocation but also increases the productivity of enterprises [114]. The unique advantages of green innovation are integrated into the operation and management of enterprises [120], which can reduce the redundancy of personnel and organizational structure [121], improve management efficiency and internal resource allocation efficiency, and ultimately promote digital transformation. In addition, Wang and Hou [95] conducted an empirical study based on the panel data of Chinese A-share listed enterprises from 2011 to 2021 and found that DT would significantly reduce ESG performance and have a negative impact on the green governance effect of the company. Therefore, the impact of DT on the ESG performance of a company is more complex.

## **5. Limitation and future work**

DT faces difficulties. Although the field of corporate green governance is significantly affected by digital transformation, at the same time, there are many difficulties in the implementation of digital transformation. In the actual operation and management of enterprises, there are two difficulties in the implementation of DT strategy: one is the limited resources mastered by enterprises. As mentioned above, DT requires a significant investment of resources, and if the resources available to the company are very limited, the DT will come to a standstill. For example, enterprises are subject to different degrees of financing constraints due to information asymmetry in the market [122], which restricts enterprises from obtaining stable cash flow and avoiding business risks [123]. The other is the challenge of how to optimize the efficiency of resource allocation. A large number of studies have shown that business performance is affected by the ability of capital operations [124,125]. Therefore, enterprises could better achieve value creation [126] and promote DT on the basis of obtaining capital and allocating it reasonably and effectively.

There is a lack of unified standards to measure the effect of corporate green governance. Existing studies have not defined the specific measurement methods of corporate green governance, although a large number of studies have analyzed green innovation [34,127], environmental governance [128], ESG performance [129], and the correlation with digital transformation. Although there is much research on the effect of green governance at the micro level, there is a lack of systematic research on the specific influence path of the corporate green governance effect at the macro level.

In the future, related research on DT and green governance should focus on breaking through the limitations of DT itself and help enterprises master a large number of core resources with the help of cutting-edge digital technology to implement the digital intelligence of green governance. Besides, it is necessary to

deepen the research in the field of green governance and explore the common laws of each specific field of green governance, including green innovation, ESG performance, etc., to provide information support for systematically measuring the effect of green governance.

## **6. Conclusion**

In general, the correlation between DT and corporate green governance can provide an important reference for the development of companies in the digital era, which could bring major changes to the corporate governance level and affect the business model and strategic planning of enterprises. At present, the company urgently needs to build a new green governance paradigm in the digital age to solve the dual challenges of digital trend and environmental protection. The solution of this paper lies in combing and reviewing the relevant literature on DT and green governance from 2014–2023, combining with the theoretical framework constructed by this study, discovering the unique advantages of DT in the field of green governance, as well as the specific impact path. This study not only enriches the research results in the two fields of DT and green governance but also provides an important reference for companies to build a new era of green governance paradigm.

In business practice, combining DT with green governance is a significant step towards digital and sustainable corporate development. From one perspective, the positive changes brought by DT in the company's internal management and external environment can not only optimize the enterprise's capital allocation, promote the improvement and promotion of operational efficiency, but also reduce the information asymmetry in the competitive market, enhance the enterprise's sensitivity to the market, and improve the operation and environmental performance. From another perspective, through improving the effect of corporate green governance, especially green innovation, enterprises can achieve the acceleration of capital accumulation and the reduction of production costs [130], which is beneficial to complete the major challenge of DT of massive resource investment and realize the digitalization and sustainable development of enterprises.

Studies on the impact of DT tend to focus on the correlation between DT and green innovation, environmental governance, and ESG performance from the micro level of green governance and lack of research on the impact mechanism of DT on green governance from the macro level. At present, scholars are paying more and more attention to the comprehensive and systematic impact mechanism of digital transformation, overcoming the inherent limitations of DT in the context of corporate governance and the major challenges brought by the limited resources mastered by enterprises, which could enrich the concepts and methods of corporate governance and promote the optimization and upgrading of the internal structure of enterprises. Meanwhile, endogenous impetus for green governance is provided [83].

On the plus side, it is an important step for enterprises to combine DT with green governance to make corporate development digital and sustainable. From one perspective, the DT brought about by the company's internal management and external environment could not only optimize the capital allocation and improve operational

efficiency of the company but also reduce the information asymmetry in the competitive market, enhance the company's sensitivity to market changes, and improve business performance and environmental performance. From another perspective, improving the effect of corporate green governance, especially green innovation, can accelerate the capital accumulation of enterprises, reduce production costs [130], complete the major challenge of DT of massive resource investment, and realize the digitalization and sustainable development of enterprises.

As the research on DT and green governance becomes more and more abundant and in-depth, how to systematically and comprehensively evaluate the relationship between the two has become the focus of scholars' research. Critical thinking and discussion of different perspectives will help companies fully understand and apply the impact mechanisms of digital transformation, optimize resource allocation, and enhance the effect of green governance. Furthermore, integrating the unique advantages of green governance and green innovation into enterprise management will help to solve the problem of redundancy, achieve efficient management and resource allocation, and ultimately promote the development of enterprise digital transformation.

**Conflict of interest:** The authors declare no conflict of interest.

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