

Enterprise Digital Transformation, Accounting Information Comparability and Corporate Innovation

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Abstract: With the rise of the digital economy, corporate digital transformation has become crucial for driving innovation and enhancing competitiveness. This study investigates the impact of digital transformation on enterprise innovation, while also considering the mediating role of accounting information comparability. The results show a significant positive relationship between digital transformation and enterprise innovation, indicating that digital transformation greatly enhances innovation. Notably, accounting information comparability plays a mediating role in this process, further strengthening the impact of digital transformation on firm innovation. These findings offer strategic recommendations for businesses to foster innovation during digital transformation and emphasize the importance of improving accounting information comparability.

Keywords: digital transformation, accounting information comparability, innovation

1. Introduction

With the development of the global economy, innovation has become the key to high-quality development of enterprises. However, innovation activities require large investments and long research and development cycles, which make the risk of innovation investment increase. Against this background, the era of digital economy brings us a new opportunity: digital transformation [1]. The Chinese government attaches great importance to this, setting clear goals for digital transformation and introducing a series of policies to promote its realization. In addition, the state has been increasing its investment in major projects such as "East Counts, West Counts" [2], and encouraging all industries to deeply integrate digital technologies to achieve high-quality economic development.

Innovation, being the core driving force of enterprise development, has been extensively studied by scholars. At the beginning of the last century, Schumpeter delved into enterprise innovation, highlighting its coverage across various dimensions such as systems, technology, market, and management. In recent years, researchers have explored factors influencing corporate innovation from different perspectives, including internal shareholding structure, company scale, external financing environment, and macro policies. However, there has been relatively little focus on the impact of digital transformation on corporate innovation. While some scholars have partially addressed this issue by examining talent effects, dynamic capabilities, and knowledge management, these studies are insufficient.

The comparability of accounting information may play a pivotal role in digital transformation. With the aid of digital technology, companies can effectively collect, integrate, and analyze data, thereby improving the comparability of their accounting information. Accounting information, when highly comparable, not only aids firms in assessing the effectiveness of their innovation strategies but also provides external investors with accurate and reliable information, consequently reducing the risk of innovation investment. Therefore, this study aims to explore how firms' digital transformation can promote innovation by influencing the comparability of accounting information.

This paper contributes in several key aspects. Firstly, it offers fresh perspectives and theoretical support to the existing literature by examining how firms' digital transformation impacts their innovation through the lens of accounting information comparability. Secondly, it sheds light on the mechanisms through which digital transformation and accounting information comparability jointly drive firm innovation. Lastly, it explores strategies for enhancing the comparability of firms' accounting information in the digital economy to better facilitate firm innovation. These contributions advance our understanding of the relationship between digital transformation, accounting information comparability, and innovation, offering valuable insights for both scholars and practitioners.

2. Theoretical Analysis and Research Hypotheses

2.1. Enterprise digital transformation and enterprise innovation

The rapid advancement of the digital economy has necessitated enterprises to undergo transformation, particularly through digital transformation, to remain competitive. Digital transformation encompasses not only technological advancements but also comprehensive changes in enterprise culture, management practices, and business models. It entails a holistic approach to adapt to the digital landscape and its evolving demands.

First, the institutional innovation aspect. Digital transformation requires enterprises to form a new set of institutional logic internally to adapt to the external digital economic environment [3]. This institutional innovation can help enterprises better adapt to the external environment, improve their responsiveness and flexibility, and thus promote innovation. Second, technological innovation aspect: digital technologies, such as big data, cloud computing, artificial intelligence, etc., provide powerful tools and means for enterprises to develop and innovate their products and services more quickly and accurately [4]. Third, market innovation aspect: digital transformation enables enterprises to better understand market demand and respond more quickly to market changes, thus promoting market innovation. Fourth, management innovation: digital transformation promotes the flattening of enterprise management, enabling enterprises to better stimulate the innovation potential of employees and improve their innovation efficiency [5]. In summary, we believe that digital transformation can promote enterprise innovation in many ways.

2.1.1. Enterprise digital transformation, accounting information comparability and enterprise innovation

In the era of the digital economy, enterprises are undergoing profound changes. Digital transformation has not only revolutionized their operational modes but has also significantly impacted their information processing and disclosure methods. With the integration of digital technology and accounting information processing, enterprises now have the ability to process diverse accounting information more swiftly and precisely. The application of technologies such as big data, cloud computing, and artificial intelligence enables enhanced accuracy and completeness in accounting information. Additionally, the speed of its disclosure is accelerated, meeting the demands of investors and other stakeholders for immediate access to information. From the perspective of transparency and trust, digital technologies such as blockchain can enhance the transparency of accounting

information [6], so that external stakeholders can view the real operating conditions of the enterprise more intuitively, thus increasing trust in the enterprise. Therefore, enterprise digital transformation can promote accounting information comparability.

When analyzing the impact of accounting information comparability on enterprise innovation, it can be assessed from four perspectives: the foundation of innovation decision-making, ease of financing, risk management and innovation, and stakeholder involvement. Firstly, highly comparable accounting information serves as crucial feedback for firms in evaluating the effectiveness of their innovation strategies. It enables them to make informed decisions and adjustments to their innovation initiatives. Secondly, enhanced comparability facilitates financing activities by providing investors and lenders with reliable and transparent information, thus attracting more financial resources to support innovation endeavors. Thirdly, comparability aids firms in managing risks associated with innovation by offering a clear understanding of their financial position and performance. This enables them to identify and mitigate potential risks effectively. Lastly, comparability fosters stakeholder engagement by providing accurate and comprehensible information, thereby encouraging their active participation in innovation-related activities. Firms are able to use this information to clearly understand which innovation projects or strategies are successful and which need to be adjusted or abandoned, so that they can allocate resources more precisely [7]. Second, financing is key in innovation activities. Highly comparable accounting information can better demonstrate a firm's operating conditions and potential growth, attracting the attention of investors and financial institutions. This will help firms to obtain financing more easily to support their innovation projects. Third, when firms' accounting information is highly comparable, they can perform risk assessment more effectively. This risk assessment can help firms better manage the risks associated with innovation, thus encouraging bolder attempts at innovation [8]. Furthermore, highly comparable accounting information can also facilitate the engagement of various stakeholders, including suppliers, customers, and partners. When these stakeholders have a better understanding of a firm's operations through comparable accounting information, they are more likely to actively participate in and support the firm's innovation initiatives. To summarize, this paper argues that digital transformation can further enhance firm innovation by improving the comparability of accounting information. Based on this premise, the following hypotheses are proposed:

H1: Digital transformation can significantly enhance corporate innovation.

H2: There is a significant mediating effect of accounting information comparability in the impact of enterprise digital transformation on enterprise innovation.

3. Research Design

3.1. Sample Source

This paper utilizes a research sample consisting of all listed companies in the A-share market between 2010 and 2020. The sample is filtered based on the following criteria: firstly, financial and insurance companies are excluded; secondly, ST and *ST listed companies are excluded; and thirdly, companies with missing required data are excluded. After applying these criteria, a total of 20,093 sample values are obtained. To mitigate the impact of outliers on the study, all continuous variables are winsorized at the upper and lower 1%. The data needed for this research is sourced from the Wind database.

3.2. Model Construction

3.2.1. Model Construction

In order to test the impact of digital transformation on enterprise innovation and the mediating effect of accounting information comparability, this paper constructs the following model, and the definitions of specific variables are shown in Table 1:

$$\text{Patent}_{i,t} = \alpha_0 + \alpha_1 \text{DCG}_{i,t} + \alpha_2 \text{Controls}_{i,t} + \text{Industry} + \text{Year} + \xi_{i,t} \quad (1)$$

$$\text{Comp}_{i,t} = \alpha_0 + \alpha_1 \text{DCG}_{i,t} + \alpha_2 \text{Controls}_{i,t} + \text{Industry} + \text{Year} + \xi_{i,t} \quad (2)$$

In the regression model, the explanatory variable ESG represents the degree of firms' ESG performance, while the explanatory variable PC indicates whether firms have political connections. The controls encompass all other control variables. Year and Industry are included as fixed effects to account for year-specific and industry-specific characteristics. The random error term is denoted by ξ .

3.2.2. Definition of variables

Explained variable: firm innovation (Innovation). Enterprise innovation can be measured from two dimensions: one is based on innovation output, usually using indicators such as the number of patent applications and authorizations [9]; the other is based on innovation input to assess the innovation activity of enterprises. In this study, we choose the method of innovation output and use the number of patent applications as a metric, based on the study of Kong Dongming et al. (2017). This method is adopted because, on the one hand, invention patents better reflect the scientific and technological innovation capability of enterprises compared with R&D inputs [10]; on the other hand, the number of patent applications is more stable than the number of patents granted, which may be affected by a variety of factors [11]. In order to eliminate data skewness, we take the logarithm of all patent values after adding 1 to get three variables: Patent, Patent1 and Patent2, which represent the total innovation quantity, innovation quality and innovation quantity of enterprises, respectively.

Explanatory variable: Degree of enterprise digital transformation (DCG). In domestic studies, the measurement of the degree of enterprise digital transformation often involves evaluating the frequency of words related to digital transformation in annual reports, as outlined by Wu Fei et al. To quantify this degree, we followed Wu Fei et al.'s methodology by counting the frequency of words associated with digital transformation in the annual reports of listed companies. Considering the skewed distribution of the data, we added 1 to the frequency of digital transformation and then applied a logarithmic transformation to obtain the variable DCG, which represents the level of digital transformation of companies.

Mediating variable: Accounting information comparability (Comp). Accounting information comparability refers to the uniformity of the accounting system, ensuring that different economic transactions are consistently represented in accounting information. In essence, greater comparability is achieved when firms apply consistent accounting treatments to similar economic activities. To measure this comparability, we adopt the approach proposed by De Franco et al. First, we perform a regression analysis using firms' data for the 16 quarters preceding period t , where $\text{Earning}_{i,t}$ represents the ratio of a firm's quarterly profit to its opening market capitalization, and $\text{Return}_{i,t}$ denotes the quarterly stock return. Assuming that firms i and j engage in the same economic activities, we utilize models (4) and (5) to predict their expected surpluses based on the estimation from model (3). Subsequently, we calculate the difference between the expected surpluses of the two firms and average the absolute values to obtain the comparability of accounting information between firms i

and j , as shown in model (5). To determine the accounting information comparability for a specific company, we match it with other companies in the same industry. Finally, we rank the comparability of each pair of firms and compute the average comparability value of the firm with all other firms in its industry (Comp). Theoretically, a higher value of Comp indicates a greater degree of comparability in the firm's accounting information.

$$Earning_{i,t} = \alpha_i + \beta_i Return_{i,t} + \varepsilon \quad (3)$$

$$E(Earning)_{i,i,t} = \alpha_i + \beta_i Return_{i,t} \quad (4)$$

$$E(Earning)_{i,j,t} = \alpha_i + \beta_i Return_{i,t} \quad (5)$$

$$Comp_{i,j,t} = -1/16 \times \sum_{t=1}^{t=15} |E(Earning)_{i,i,t} - E(Earning)_{i,j,t}| \quad (6)$$

Control Variables. The control variables in this paper include firm size (Size), gearing ratio (Lev), return on total assets (ROA), growth rate of firm's operating income (Growth), number of directors (Board), percentage of independent directors (Indep), percentage of shareholding of the first largest shareholder (Top1), degree of equity checks and balances (Balance), and structure of ownership (SOE). The paper concludes by also controlling for year effects and fixed effects. This is shown in Table 1:

Table 1: Table of control variable definitions

Variable Name	Variable Symbol	Variable Definition
Enterprise Size	Size	Taking the natural logarithm of total business assets
Gearing Ratio	Lev	Total liabilities/total assets
Return on Total Assets	ROA	Net profit / total assets
Operating Revenue Growth Rate	Growth	(Current Operating Income - Previous Operating Income)/Previous Operating Income
Number of Directors	Board	Number of Board of Directors
Proportion of Independent Directors	Indep	Number of independent directors/total number of board members
Shareholding ratio of the largest shareholder	Top1	Number of shares held by the first largest shareholder/total number of shares
Shareholding checks and balances	Balance	Total percentage of shares held by the second to fifth largest shareholder / percentage of shares held by the first largest shareholder
Ownership Structure	SOE	If the enterprise is a state-owned enterprise, take 1, otherwise take 0

3.3. Descriptive statistics of variables

Table 2 presents the descriptive statistics for the variables under analysis. Regarding corporate innovation, the means are 2.589, 1.785, and 2.076, with corresponding standard deviations of 1.712, 1.503, and 1.640, revealing significant variation in innovation levels across different firms. Similarly, the means and standard deviations of digital transformation (DCG) are 1.412 and 1.416, respectively, indicating a substantial degree of dispersion in the degree of digital transformation. These findings highlight the diversity of the sample data, which satisfies the statistical requirements for analysis.

Table 2: Descriptive statistics of variables

Variable	N	Mean	Std Dev	min	max
Patent	20,093	2.589	1.712	0	7.18
Patent1	20,093	1.785	1.503	0	6.531
Patent2	20,093	2.076	1.640	0	6.332
DCG	20,093	1.412	1.416	0	4.934
Comp	20,093	-0.009	0.007	-0.039	0.003
Size	20,093	22.38	1.302	19.52	26.21
Lev	20,093	0.467	0.209	0.0668	0.961
ROA	20,093	0.0323	0.0683	-0.289	0.217
Growth	20,093	0.179	0.564	-0.632	4.124
Board	20,093	8.687	1.720	5	15
Indep	20,093	0.3749	0.0538	0.3333	0.5714
Top1	20,093	0.3400	0.1464	0.0923	0.7365
Balance	20,093	0.0066	0.0057	0.0002	0.0255
SOE	20,093	0.465	0.499	0	1

4. Empirical results and analysis

4.1. Benchmark regression analysis

The regression analysis results of model (1) in Table 3 demonstrate the correlation coefficients between the enterprise's degree of digital transformation (DCG) and the innovation indicators Patent, Patent1, and Patent23. The coefficients are 0.269, 0.285, and 0.215, respectively, indicating that a 10% increase in the degree of digital transformation is associated with a corresponding increase in the enterprise's innovation level by 2.69%, 2.85%, and 2.15%, respectively. This finding signifies a significant positive correlation between digital transformation and innovation, which is statistically significant at the 1% level. Thus, the higher the degree of digital transformation, the greater its positive contribution to corporate innovation, thereby confirming the H1 hypothesis.

Furthermore, the correlation coefficient between the degree of digital transformation (DCG) and the comparability of accounting information (Comp) is 0.023. This implies that a 10% increase in the degree of digital transformation results in a 0.23% increase in the comparability of accounting information. This finding solidly supports the significant positive impact of digital transformation on the comparability of accounting information, which is statistically significant at the 1% level.

Table 3: Benchmark regression results

Variable	model(1)			model (2)
	Patent	Patent1	Patent2	Comp
DCG	0.269*** (29.987)	0.285*** (32.350)	0.215*** (22.175)	0.023*** (8.295)
Constant	-75.093*** (-10.220)	-59.717** (-8.228)	-61.193*** (-7.672)	16.383*** (7.185)
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Observations	20,093	20,093	20,093	20,093
R-squared	0.103	0.105	0.116	0.280

Note: ***, **, and * denote significant at the 1%, 5%, and 10% levels, respectively, and t-values in parentheses are the same as below.

4.2. Robustness tests

4.2.1. Propensity score matching method (PSM)

To address the issue of sample self-selection, this study employs the propensity score matching method (PSM). The top 25% of enterprises, categorized by their digital transformation level, are treated as the experimental group with a high level of digital transformation, while the remaining enterprises form the control group. A dummy variable, DCG_dum, is introduced to assign a value of 1 to the experimental group and a value of 0 to the control group. Additionally, enterprise characteristics such as profitability (Loss), dual employment (Dual), ownership structure (Soe), and affiliation with a Big 4 auditing firm (Big4) are taken into account. Radius matching method is utilized for pairing, with a threshold value of 0.01, resulting in 10,824 valid samples.

The parallel hypothesis testing results for PSM indicate significant differences between the experimental and control groups regarding various characteristics prior to matching. This suggests the presence of confounding variables. However, after matching, these differences are substantially reduced, indicating successful matching and ensuring consistency between the experimental and control groups in terms of key features. This further confirms the efficacy of PSM. Subsequently, based on the refined sample, a regression analysis is conducted to examine the relationship between the degree of digital transformation and firm innovation. As shown in columns (1), (2), and (3) of Table 4, the results of the analysis continue to support the initial hypothesis.

4.2.2. Lagged explanatory variables

In response to the aforementioned findings regarding the impact of firm's degree of digital transformation on firm innovation, some questions may arise. Specifically, there could be certain unobserved factors that affect both firm digital transformation and firm innovation, leading to biased results. Additionally, given that innovation is a time-consuming process, the issue of endogeneity should not be overlooked.

To address these concerns, this study adopts the approach proposed by Mao Ning (2022), which involves lagging all explanatory variables by one period. This technique helps to mitigate the potential endogeneity problem. As depicted in columns (7), (8), and (9) of Table 4, even after incorporating these lags, the results show that every 1% increase in the degree of digital transformation (DCG) leads to a 0.225%, 0.226%, and 0.148% increase in Patent, Patent1, and Patent23, respectively. These findings remain statistically significant at the 1% level, reaffirming the validity of hypothesis H1.

Table 4: Robustness test results

Variable	(1) Patent	(2) Patent1	(3) Patent2	(4) Patent	(5) Patent1	(6) Patent2
DCG	0.312*** (24.292)	0.328*** (26.377)	0.237*** (16.519)	0.225*** (25.754)	0.226*** (28.768)	0.148*** (17.910)
Constant	-59.117*** (-5.073)	-39.842*** (-3.418)	-51.937*** (-4.135)	-63.317*** (-8.793)	-37.071*** (-5.762)	-55.646*** (-7.880)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10824	10824	10824	20,093	20,093	20,093
R-squared	0.085	0.083	0.080	0.251	0.231	0.210

4.3. Conclusions and insights

This study provides compelling evidence of a significant and positive relationship between the degree of digital transformation and corporate innovation. As firms invest in and deepen their digital transformation efforts, it directly enhances their innovation activities and capabilities. This reaffirms the crucial role of digital transformation in the current economic landscape for fostering sustained growth and competitiveness among firms. Furthermore, the study reveals that digital transformation significantly contributes to enhancing the comparability of accounting information. Most importantly, this improved comparability acts as a mediator between digital transformation and firm innovation, meaning that digital transformation further promotes innovative activities by enhancing accounting information comparability.

Based on the research insights derived from this study, several recommendations can be made. Firstly, it is essential for enterprises to strategically deepen their digital transformation initiatives. Recognizing that digital transformation is not just a technological upgrade, but a key driver of innovation and competitiveness, firms should align their digital transformation plans with long-term goals and strategies. Secondly, attention should be given to the quality and comparability of accounting information during the digital transformation process. Enterprises ought to prioritize efforts in improving the quality and comparability of accounting information, which not only meets the information needs of external stakeholders but also provides a more accurate foundation for internal decision-making. Lastly, continuous supervision and training are vital. Given the significance of digital transformation and accounting information comparability, regulatory bodies should enhance guidance and oversight of enterprise digital transformation. Simultaneously, encouraging firms to provide relevant training and education for employees can ensure the smooth and successful implementation of digital transformation.

References

- [1] WANG Yinghuan, GUO Yongzhen. *Corporate digital transformation and ESG performance - Empirical evidence based on Chinese listed firms*[J]. *Financial Research*, 2023, 49(09): 94-108.
- [2] Gao Houbin, Wang Qiangrui. "The gift of green": The impact of digital transformation on corporate environmental performance-Empirical evidence from A-share listed companies in China's manufacturing industry[J/OL]. *Journal of Henan Normal University (Philosophy and Social Science Edition)*, 2023(05): 88-94[2023-09-06].
- [3] Gu Limei, Zhang Yang, Hao Wenqiang. *Digital transformation of China's governance under the perspective of "value-tool"*[J/OL]. *Journal of Xi'an Jiaotong University (Social Science Edition)*: 1-17[2023-09-06].
- [4] Lu Kefu, Yu Mingyang, Ruan Yongping. *Enterprise digital transformation and resource allocation efficiency*[J]. *Research Management*, 2023, 44(08): 11-20.
- [5] JI Cheng, DING Shouhai. *Digital transformation, inter-industry technology spillover and skill wage premium*[J/OL]. *Scientology Research*: 1-18[2023-09-06].
- [6] Zhong Tingyong, Huang Yibo, Sun Fangcheng. *Enterprise digital transformation, market competition and comparability of accounting information*[J]. *Modern Finance and Economics (Journal of Tianjin University of Finance and Economics)*, 2022, 42(12): 21-43.
- [7] Zhang Yanzhao, Bu Jun. *Will the digital transformation of enterprises affect the comparability of accounting information*[J]. *Journal of Zhongnan University of Economics and Law*, 2023(02): 41-51.
- [8] YU Biao, YANG Gang. *Accounting Information Comparability and Corporate Labor Investment Efficiency*[J]. *Investment Research*, 2022, 41(06): 31-58.
- [9] KONG Dongmin, XU Mingli, KONG Gaowen. *Internal pay gap and innovation in enterprises* [J]. *Economic Research*, 2017 (10): 144 ~ 157.
- [10] Xuan Zhou, Liru Cheng, Hao Wang. *Is the higher the level of technological innovation the better the financial performance of enterprises? --An empirical study based on 16 years of patent application data of Chinese pharmaceutical listed companies* [J]. *Financial Research*, 2012(8): 166 ~ 179.
- [11] WU Fei, HU Huizhi, LIN Huiyan, REN Xiaoyi. *Corporate digital transformation and capital market performance - Empirical evidence from stock liquidity* [J]. *Management World*, 2021(7): 130 ~ 144+10.