Print ISSN: 1738-3110 / Online ISSN 2093-7717
JDS website: http://accesson.kr/jds
http://doi.org/10.15722/jds.22.11.202411.101

The Impact of COVID-19 on Value Relevance in Distribution and Service Industries

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Received: October 10, 2024. Revised: October 29, 2024. Accepted: November 05, 2024.

Abstract

Purpose: The study seeks to empirically evaluate how the COVID-19 pandemic has affected the value relevance of companies within the logistics and distribution industries. It specifically investigates how digital transformation and the implementation of Smart supply chain management (SCM) responded to the heightened complexity of logistics processes in the post-pandemic environment and whether these systems contributed to an increase or decrease in value relevance. **Research design, data and methodology:** Using Ohlson's (1995) valuation model, we analyze how the value relevance of accounting information in the logistics and distribution industry has changed during the post-COVID period from 2020 to 2023. This period is characterized by disruptions such as supply chain interruptions, labor shortages, and shifts in consumer demand, resulting in delayed shipments and increased operational costs, which likely impact the firm's value relevance. **Results:** Despite increases in earnings and book values in the logistics industry post-COVID-19, the value relevance of these metrics declined. **Conclusions:** The rapid digitalization and implementation of smart SCM have introduced complexities and heightened risks, which may have raised concerns among investors. Additionally, there has been a shift in focus toward non-financial factors, such as ESG concerns and technological competitiveness, suggesting that traditional financial metrics inadequately capture a firm's value.

Keywords: Distribution and Service Industries, Supply Chain Management, Logistics, COVID 19 Pandemic, Value Relevance

JEL Classification Code: L81, L92, M44

1. Introduction

The COVID-19 pandemic brought about significant disruptions to the global economy and societal structures, with particularly severe impacts on distribution and logistics systems. The pandemic caused the breakdown of existing supply chains, leading to sharp increases in logistics costs and transportation delays, which in turn threatened traditional distribution models (Goel et al., 2021; Golan et al., 2020). For instance, from early 2020, shipping costs between Asia and Europe surged dramatically, and bottlenecks at major ports severely undermined the efficiency of global logistics systems. Traditional distribution companies faced existential threats due to widespread store closures and declining offline sales. The rapid expansion of online shopping and e-commerce then forced them to adapt to a newly emerging market environment. Fortunately, even before the pandemic, the

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global spread of the Fourth Industrial Revolution had already begun to drive the adoption of smart supply chain management (SCM). This is a new business system based on automation, autonomy, and connectivity that enables real-time data collection and analysis, facilitating comprehensive communication among all participants in the supply chain (Frederico et al., 2021a, 2021b). This approach plays a crucial role in enhancing the agility of supply chains and improving customer satisfaction through intelligent decision-making. The innovations in digital technologies and business models may have provided the capacity to respond to the supply chain crisis triggered by the pandemic, significantly mitigating the challenges faced by the distribution industry (El Baz & Ruel, 2021). Based on this context, our study aims to empirically analyze how supply chain innovations in the distribution industry have protected and restored corporate value during crises such as the pandemic. Specifically, we seek to determine whether the digitization enabled by the adoption of smart SCM helped minimize supply chain disruptions, reduce logistics costs, and ultimately preserve or enhance firm value during the pandemic. This is a critical research topic, particularly as technologies such as the Internet of Things (IoT), artificial intelligence (AI), blockchain, and big data analytics have played an instrumental role in strengthening the resilience of the distribution and logistics sectors. Analyzing how these technologies contributed to overcoming the pandemic-induced challenges will provide important insights for preparing for future shifts in the industrial landscape.

We aim to investigate the impact of digital transformation and supply chain management implementation on the value relevance of accounting information in the logistics and distribution industry before and after the pandemic. Specifically, we seek to analyze whether the strategic execution of digital innovation in the distribution sector, aimed at improving complex logistics processes and managing risks, ultimately affects corporate value as reflected in accounting figures, comparing the periods before and after COVID-19. This analysis will help determine whether companies in the logistics and distribution industry can build trust with investors by providing clear information about their digital innovation and crisis response capabilities. Additionally, we will examine whether the innovative changes in the distribution industry during the COVID-19 crisis, characterized by supply chain disruptions, fluctuations in demand, and increased operational challenges, are adequately reflected in accounting information, thereby accurately representing corporate value.

If the value relevance of accounting information decreased during this period, it may indicate that traditional financial metrics are insufficient to capture the complexities and uncertainties faced by firms, resulting in a misalignment between reported figures and actual firm value. Conversely, if the value relevance of accounting information has increased post-COVID, it may strengthen relationships with investors and enhance capital acquisition opportunities. Thus, our study holds academic significance by providing critical insights for firms in the distribution industry striving to navigate complexities in a rapidly changing environment. By understanding the relationship between digital innovation and the value of accounting information, firms can make better-informed decisions and achieve sustainable growth and competitiveness.

The structure of this paper is as follows. Section 2 provides a review of related literature and formulates the research hypothesis. Section 3 outlines the empirical model and defines the measurement variables used to test the hypothesis. Section 4 presents the results of the empirical analysis and offers an interpretation of the findings. Finally, Section 5 discusses the empirical analysis results of this study, while Section 6 presents the conclusion.

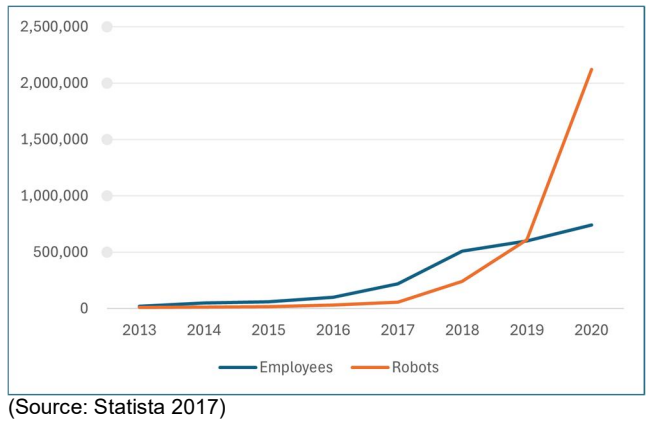
2. Theoretical Background and Research Hypothesis

The advent of the Fourth Industrial Revolution has accelerated the digitalization of the logistics and distribution industries, significantly impacting supply chain stability and cost structure improvements. According to Queiroz et al. (2021), digitalization greatly enhances supply chain transparency, enabling faster and more accurate decision-making. It also aids in the early detection of risks, thereby effectively mitigating supply chain disruptions. This plays a crucial role in reducing uncertainty and enhancing stability in supply chain management. Ivanov (2020a, 2020b) explained how digitalized supply chains have strengthened resilience during global crises, such as the COVID-19 pandemic. Their research highlights how real-time tracking enabled by the IoT, demand forecasting using AI, and transparent transaction systems based on blockchain have significantly contributed to the stability of supply chains. These technologies, they argue, provide the capacity for supply chains to continue operating even during times of crisis. Furthermore, other studies suggest that technologies such as autonomous transportation systems can reduce transportation costs and improve overall operational cost structures. Hofmann and Rüsch (2017) focused on the impact of automation and digitalization in logistics, reporting that automation technologies contribute to greater operational efficiency and cost savings in logistics operations.

Wamba and Akter (2019) analyzed the effects of big data analytics on reducing logistics costs, finding that the use of real-time data and AI for optimized route planning

and accurate demand forecasting is a key factor in cost reduction. Their research supports the idea that a variety of automation technologies, such as warehouse optimization, route optimization, and improved demand forecasting, enhance the efficiency of logistics systems and contribute to cost savings. Moreover, several studies have shown that blockchain technology in logistics systems reduces unnecessary costs by eliminating opacity in transactions and transportation processes, thereby providing greater transparency across the entire process. Kouhizadeh and Sarkis (2018) and Saberi et al. (2019) reported that blockchain technology addresses issues of information asymmetry within the supply chain, enhancing operational efficiency by increasing the reliability of transactions. These studies provide a comprehensive analysis of how the digitalization of logistics and distribution systems, driven by the Fourth Industrial Revolution, affects supply chain stability and cost structures. Ultimately, this digitalization has the potential to enhance operational efficiency, improve supply chain stability, and elevate corporate value through cost structure improvements within the distribution industry.

Amazon, a leader in the global e-commerce market, generated approximately $574.79 billion in annual revenue in 2023, with a market capitalization of $1.97 trillion by September 2024. Renowned for its advanced logistics system, Amazon exemplifies cutting-edge smart SCM by leveraging technologies from the Fourth Industrial Revolution, including big data analytics, AI, and the IoT. These technologies have transformed Amazon's automated warehouse operations, streamlining the processes of receiving, dispatching, and inventory management. Real-time data analytics enables the company to respond swiftly to fluctuating customer demand, resulting in faster delivery times and significant reductions in operational costs. The integration of robotics into Amazon's fulfillment centers has further enhanced efficiency by automating tasks such as product movement and sorting. Figure 1 illustrates the scale of personnel and robots at Amazon's fulfillment centers from 2013 to 2020. As of 2020, Amazon had deployed around 200,000 Kiva robots across its global network, significantly decreasing reliance on human labor and increasing processing speed and accuracy. Additionally, IoT technology facilitates real-time shipment tracking, allowing customers to monitor their orders, which enhances supply chain transparency. This transparency builds customer trust and positively impacts Amazon's overall market value. Amazon's strategic integration of advanced digital technologies within its logistics framework highlights how effective smart SCM can drive operational efficiency and create a competitive edge in the global marketplace. By continuously innovating its supply chain processes, Amazon not only meets consumer demands but also maintains its leadership position in the e-commerce industry.



(Source: Statista 2017)

Figure 1: The scale of human labor and robotic systems within Amazon fulfillment centers

Subsequently, the COVID-19 pandemic presented unprecedented challenges to the logistics and supply chain industry, leading to significant risks and disruptions that adversely affected overall operational effectiveness and efficiency. The pandemic caused widespread financial instability, disrupted supply chains, and led to a substantial decline in demand for many products.

Ivanov (2020) emphasized that the pandemic intensified existing vulnerabilities in global supply chains. This led to longer lead times and stock shortages, which adversely affected financial performance. Similarly, Shaf et al. (2020) reported that the pandemic accelerated financial risks, disrupted supply chains, decreased demand, and ultimately reduced sales and profit margins for numerous businesses. This widespread disruption was primarily a result of the abrupt halt in production and logistics activities across various sectors, leaving companies ill-equipped to manage such a profound shock. Moreover, Van Hoek (2020a, 2020b) concluded that many organizations faced severe adverse effects given their inadequate preparedness and insufficient response plans for crises of this magnitude. The sudden nature of the pandemic forced many firms to rapidly adapt their operations and supply chains, exposing significant vulnerabilities within their logistics systems. However, some studies suggest that whereas COVID-19 introduced numerous challenges, it also provided opportunities for businesses to reassess their operational strategies. For example, Rizoua et al. (2020) observed that despite the difficulties encountered in the supply chain and food industries, the pandemic prompted organizations to revise and enhance existing processes related to the processing and delivery of goods. This viewpoint highlights the dual nature of the crisis, as it not only revealed weaknesses but also spurred innovation and adaptation within the industry.

The COVID-19 pandemic has underscored several factors that could lead to significant changes in the value relevance of the logistics and distribution industry. Before

the pandemic, many companies were focused on maximizing logistics efficiency by implementing smart SCM systems and pursuing digital transformation. However, the unforeseen challenges brought about by the pandemic may have prevented these initiatives from yielding the anticipated outcomes.

Whereas digital transformation and the adoption of SCM in the distribution sector are generally expected to enhance operational efficiency and positively influence book value and net income through cost reductions, it is essential to consider that the complexities introduced during the pandemic may have inadvertently diminished value relevance. For instance, the rapid transition to online business models could have intensified logistical complexities, leading to increased challenges in delivery and inventory management. These complications might have disrupted the smooth operation of digital systems, ultimately affecting the relationship between firms' book value and net income.

Additionally, accounting information may not adequately reflect the changes occurring in technology and SCM practices within the logistics and distribution sector. As investors increasingly prioritize non-financial information—such as sustainability metrics and digital capabilities—over traditional financial data, the relevance of accounting information may be further impacted. If investors place greater emphasis on these non-financial factors, the perceived value relevance of book value and net income could decline.

Conversely, companies that successfully implemented digital innovations during the pandemic may have demonstrated remarkable adaptability in the face of unprecedented challenges. For example, those who quickly embraced e-commerce platforms, automated logistics processes, and data-driven decision-making were often better positioned to navigate the disruptions caused by the crisis. By leveraging technology to optimize their operations, these companies could streamline their supply chains, improve inventory management, and enhance customer service. This adaptability not only allowed them to maintain operational continuity but also enabled them to seize new market opportunities that arose during the pandemic, such as the surge in online shopping. As a result, their ability to respond effectively to the changing landscape may have positively impacted their financial performance. In these instances, the value relevance of accounting metrics, such as book value and net income, could increase because investors would recognize that these companies are not only surviving but thriving in a challenging environment. This heightened recognition of resilience and adaptability could lead to a stronger alignment between reported accounting figures and actual corporate value.

Given these considerations, we set the following null hypothesis to examine the impact of digital transformation and SCM implementation on the value relevance of accounting information in the logistics and distribution industry before and after the COVID-19 pandemic:

[H] There is no difference in the value relevance of book value and net income in the distribution industry before and after the COVID-19 crisis.

3. Research Methodology

3.1. Research Model

This study aims to analyze how the value relevance of accounting information in the logistics and distribution industry has changed before and after the COVID-19 pandemic, using Ohlson's (1995) valuation model. This represents stock value as a linear function of the book value of equity and net income. To begin, we establish Equation (1) to assess the overall value relevance of firms in the logistics and distribution industry over the entire sample period. We specifically test the relationship between net assets, net income, and stock prices. Furthermore, to examine differences in the value relevance of accounting information between the pre- and post-COVID-19 periods, we use a dummy variable (COVID) and formulate Equation (2) to capture these period-specific effects. Equation 2 serves as a critical framework for examining the shifts in expectations of capital market participants regarding the accounting information of firms operating within the logistics and distribution industry post-COVID-19. This equation facilitates the investigation of the relationship between various accounting metrics and stock price movements, particularly in the context of the pandemic's impact.

$$PRICE_{i,t} = \beta_0 + \beta_1 EPS + \beta_2 BPS + \varepsilon_{i,t} \quad (1)$$

$$PRICE_{i,t} = \beta_0 + \beta_1 EPS + \beta_2 BPS + \beta_3 COVID + \beta_4 COVID*EPS + \beta_5 COVID*BPS + \varepsilon_{i,t} \quad (2)$$

If the empirical analysis reveals that the coefficients β4 and β5 yield significant negative values, it indicates a marked decrease in the reliability assigned to the accounting information of these firms by investors in the aftermath of the pandemic. Such a finding suggests that the accounting information, which typically serves as a fundamental basis for investment decisions, has lost its credibility. This leads to diminished relevance in predicting stock prices. This could stem from heightened uncertainty regarding future earnings and cash flows, as firms grapple with the operational complexities introduced by the pandemic (Gao et al., 2021; Cevik et al, 2022).

Conversely, should the analysis indicate that the coefficients β4 and β5 present significant positive values, this would imply a favorable reassessment by investors of the current earnings information of these firms. Such an outcome suggests that investors perceive strong growth potential in these firms, recognizing their ability to navigate the post-pandemic landscape effectively. Furthermore, if the book values reflect a positive outlook on the firms' sustainability, it would indicate that investors trust the accounting information as a reliable indicator of financial health and future performance (Cui et al., 2021). This nuanced understanding of how capital market expectations evolve in response to unprecedented events like the COVID-19 pandemic is essential for stakeholders aiming to enhance their decision-making processes in the logistics and distribution sector. <Table 1> describes the variables used in the model.

Table 1: Variable Measurement

Variable	Measurement
PRICE	The closing stock price on the last trading day of the fiscal year
EPS	Earnings per share(Net Income/Weighted Average Outstanding shares)
BPS	Book value per share(Book value/ Weighted Average Outstanding shares)
COVID	If the period is between 2020 and 2023, then COVID = 1; otherwise, COVID= 0.

3.2. Sample Selection

This study examines companies in the logistics and distribution industry listed on the stock exchange from 2013 to 2023. To ensure consistency in the data, the sample was limited to firms with a fiscal year ending in December, and financial data were obtained from the DATA-GUIDE database. To control for the influence of outliers, all variables used in the empirical analysis are winsorized at the 1st and 99th percentiles. Based on these criteria, the final sample consists of 1,124 firm-year observations. The period from 2020 to 2023 was designated as the post-COVID period to analyze changes in the value relevance of accounting information in the logistics and distribution industry following the significant disruptions caused by the COVID-19 pandemic.

4. Empirical Analysis

4.1. Descriptive Statistics

Panel A of Table 2 presents the descriptive statistics for the variables used in the study, based on the full sample. The average stock price for firms in the logistics industry listed on the Korea Exchange between 2013 and 2023 is 33,342 WON, with a median of 11,490 WON. The fact that the mean is significantly higher than the median indicates that the sample includes a considerable number of firms with relatively high stock prices. The mean (median) of BVPS is 44,606 won (10,425 won), and the mean (median) of earnings per share (EPS) is 2,287 won (375 won). To distinguish between the pre- and post-COVID-19 periods, the variable COVID was assigned, with a mean value of 0.393, indicating that 39.3% of the total 1,124 firm-years, or 442 firm-years, correspond to the post-COVID period. Panel B represents the pre-pandemic period, comprising 682 firm-year observations. During this time, the mean (median) stock price was 36,229 won (10,850 won), with an average EPS of 2,103 won and an average book value per share (BPS) of 44,537 won. Panel C presents the descriptive statistics for the post-pandemic period, which includes 289 firm-year observations. The mean (median) stock price in this period was 28,887 won (11,865won), with an average EPS of 2,566 won and an average BPS of 44,713 won. Following the pandemic, the average stock price of companies in the logistics and distribution industry has declined, whereas both EPS and book value per share (BPS) have increased.

Table 2: Descriptive Statistics

Panel. A: Full Sample (n=1,124)					
Variable	**Mean**	**Std**	**Min**	**Med**	**Max**
PRICE	33,342	53,814	146	11,490	404,000
EPS	2,287	6,616	-8,027	375	41,130
BPS	44,606	90,262	320	10,425	557,110
COVID	0.393	0.489	0.000	0.000	1.000

Pre COVID-19 period vs Post-COVID-19 period

Panel. B: Pre COVID-19 period (n=682)		
Variable	**Mean**	**Med**
PRICE	36,229	10,850
EPS	2,106	345
BPS	44,537	11,368
Panel. C: Post-COVID-19 period (n=442)		
Variable	**Mean**	**Med**
PRICE	28,887	11,865
EPS	2,566	394
BPS	44,713	9,441

Note: Variable definitions: refer to <Table 1>

4.2. Correlation Analysis

<Table 3> shows the correlations between the primary variables used in this study. Over the entire sample period, EPS and BPS were found to have a significant correlation with stock prices, indicating that both variables are value-relevant in the market. Additionally, EPS and BPS themselves exhibited a strong positive correlation, suggesting that firms with higher profitability tend to have a stronger asset base as reflected in their book values

Table 3: Pearson's Correlations (n=1,124)

	PRICE	EPS	BPS	COVID
PRICE	1	0.631	0.773	-0.067
		(<.0001)	(<.0001)	(0.025)
EPS		1	0.643	0.034
			(<.0001)	(0.255)
BPS			1	0.001
				(0.975)
COVID				1

Note: Variable definitions: refer to <Table 1>. Values in parentheses are p-values.

4.3. Regression Analysis

Table 4 presents the results of a regression analysis conducted to examine the value relevance of accounting information within the logistics and distribution industry. The key variables used in this analysis are EPS and BPS. Both of these are commonly considered indicators of a firm's financial health and are expected to be relevant to market participants when evaluating firm value. The regression coefficient for EPS is 1.867, which is statistically significant. This finding implies that earnings information is highly useful for investors and other stakeholders when assessing the firm value in the logistics and distribution industry. The significance of this coefficient suggests that firms' net income, as reflected in EPS, plays a critical role in how market participants evaluate these companies, aligning with the general expectation that earnings are a key determinant of firm value.

Similarly, the regression coefficient for BPS is 0.373, also statistically significant and positive. This indicates that book value, which reflects the value of a company's assets net of liabilities, retains value relevance in the industry. The positive coefficient suggests that investors consider the asset base of logistics and distribution firms as an important factor when determining the company's stock price, alongside profitability.

Table 4: The Value Relevance in the Distribution and Service Industries

Dependent Variable: PRICE		
Variables	**coefficient**	**t-value**
Intercept	12447.0	11.38***
EPS	1.867	9.65***
BPS	0.373	26.29***
F-value	945.73***	
Adjusted R^2	0.627	
Sample Size	1,124	

Note: ***, **, and * denote statistical significance at the 0.01, 0.05, and 0.10 levels, respectively.
Variable definitions: refer to <Table 1>.

<Table 5> presents the results of a regression analysis investigating how the value relevance of accounting information in the logistics and distribution industry changed after the COVID-19 pandemic. This analysis considers the impact of the pandemic on the use of EPS and BPS for evaluating firm value. This is given the contrasting pressures of a logistics crisis and the ongoing digital transformations known as the Fourth Industrial Revolution. The coefficient for the interaction term COVID*EPS is -1.198, which is statistically significant and negative. This finding indicates that the value relevance of EPS—or the extent to which investors rely on net income information when evaluating firm value—has diminished in the post-COVID period for logistics and distribution companies. Despite the increase in EPS during this time, investors appear to assign less importance to earnings information when making value assessments. The disruptions in the logistics sector caused by the pandemic may have introduced significant uncertainties, leading investors to question the stability of earnings as a reliable indicator of future firm performance. Similarly, the coefficient for the interaction term COVID*BPS is -0.133, also statistically significant and negative. This result implies a decline in the value relevance of BPS, meaning that investors are less likely to rely on book value information to assess firm value after the pandemic. This could be attributed to the increased operational risks and uncertainties faced by logistics companies, where assets, even if accurately reflected in accounting records, may not guarantee the same level of security or future profitability in a post-pandemic environment. In summary, the empirical results of Table 5 suggest that the traditional financial metrics of EPS and BPS have lost some of their relevance for market participants in the logistics and distribution sector following COVID-19. The crisis has likely shifted investors' focus toward other factors, such as non-financial information and qualitative assessments of a firm's adaptability and resilience in a rapidly changing environment.

Table 5: The Impact of COVID-19 on Value Relevance in the Distribution and Service Industries

Dependent Variable: PRICE		
Variables	**coefficient**	**t-value**
Intercept	12,108.0	9.00***
EPS	2.531	10.05***
BPS	0.422	23.87***
COVID	432.241	0.200
*COVID*EPS*	-1.198	-3.23***
*COVID*BPS*	-0.133	-4.82***
F-value	436.61***	

4. Discussion

The results suggest that, despite improvements in profitability and book values, the value relevance of traditional accounting metrics like EPS and BPS has diminished in the post-COVID period. This is likely owing to increased operational complexities, heightened uncertainty, and a shift in investor focus toward non-financial information such as supply chain resilience and digital innovation. These findings highlight the limitations of traditional accounting information in fully capturing the drivers of firm value in a rapidly changing, digitally driven post-pandemic environment. Firms in the logistics and distribution industry may need to focus on providing investors with more comprehensive information that includes both financial and non-financial factors to better reflect their overall value.

Specifically, the logistics and distribution industry is inherently linked to greenhouse gas emissions, energy consumption, and resource efficiency throughout logistics processes. Thus, information regarding how companies fulfill their environmental responsibilities is critical. In recent years, information related not only to crisis management concerning climate change but also to efforts in preserving biodiversity, protecting human rights, and fostering community relations—factors associated with sustainability-related risks and opportunities—has become key to decision-making and corporate valuation for information users. Accordingly, it is essential that sufficient information on risks and opportunities related to sustainable management is provided.

6. Conclusion

Amid the wave of the Fourth Industrial Revolution, the logistics and distribution industry is experiencing significant system transformations, with the COVID-19 pandemic serving as a critical turning point in this process. The empirical findings of this study reveal that, despite increases in earnings and book values in the logistics industry post-pandemic, the value relevance of these metrics has declined. These results carry several key implications.

First, following the pandemic, logistics companies have made significant efforts to reduce costs and enhance profitability; however, the swift growth of online business has introduced substantial complexities to logistics operations. This complexity is closely tied to the operational risks and uncertainties that have escalated with the acceleration of digitalization and the implementation of smart SCM. These increased risks likely sent negative signals to investors, especially when persistent structural issues, such as supply chain vulnerabilities, remained unresolved, or when digital transformation did not garner the expected level of trust. Consequently, the financial information may have failed to adequately reflect the long-term value of firms.

Second, in the post-pandemic economic environment, non-financial factors such as environmental, social, and governance (ESG) concerns and technological competitiveness likely played a more significant role in the evaluation of companies. Investors may have shifted their attention from traditional financial performance to qualitative factors like digital innovation, crisis management, and adaptability to new technologies. This shift suggests that conventional accounting metrics have limitations in fully capturing a firm's value. This may explain the observed decline in the value relevance of financial information.

In conclusion, the decline in the value relevance of financial information in the logistics industry after the pandemic can be attributed to the combined effects of the increasing complexity of digital transformation heightened future uncertainty, and the growing importance of non-financial factors. This study emphasizes that digital innovation in the logistics and distribution industry should go beyond mere technology adoption to encompass strategic approaches for improving complex logistics processes and managing risks. It highlights the necessity for companies to pursue continuous innovation and adaptability in response to changing environments. By providing clear information to investors regarding digital innovation and crisis-response capabilities, firms can build trust and ensure that such information accurately reflects their value. This approach not only strengthens relationships with investors but also enhances capital acquisition prospects. These findings provide essential insights for companies seeking to navigate the complexities of a rapidly changing landscape effectively.

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