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Article

Does Technology Need Cultural Impetus? Evidence From Chinese Manufacturing Enterprises

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Abstract

The relationship between technology and culture is a topic of significant interest in the field of social development. The advent of ChatGPT has prompted a re-examination of this relationship, particularly in the context of the role of technology in driving social change. However, the phenomenon of prioritising technology over culture is a common occurrence in contemporary enterprises. In light of this, this study focuses on information techonology (IT) investment behavior in China's manufacturing enterprises as a case study to investigate the impact of corporate culture on the advancement of technology within these organisations. Using panel data from A-share listed manufacturing enterprises from 2013–2022, a series of regression analyses using the fixed effects model finds that Chinese enterprises' IT investment has a positive impact on corporate performance and that corporate culture strength can further promote the positive effect of corporate IT investment on corporate performance. In addition, this paper examines how distinct corporate culture dimensions influence IT investment outcomes, and the results show that there are differences in the impact of various corporate culture dimensions on IT investment performance, with honesty-oriented cultures exerting a particularly strong positive effect. This study deepens the understanding of the relationship between culture and technology development, highlighting how corporate culture construction shapes IT investment performance. It therefore holds important theoretical and practical significance.

Keywords: science and technology culture; technological development; IT investment; enterprise performance
JEL: M14, L25, M19

1. Introduction

In the contemporary context where information technology is profoundly intertwined with social development, the advancement of technology and the evolution of culture exhibit a complex interplay. Technological innovation not only reconfigures the paradigms of cultural production and dissemination—giving rise to new digital cultural forms—but also provokes profound philosophical inquiry into the relationship between technological rationality and humanistic values. Nowadays, governments and enterprises are focusing more on the development of technology than on that of culture. Recently, the widespread use of natural language processing technologies, like the Artificial Intelligence-driven (AI-driven) ChatGPT, has raised many concerns (Karakose, 2023). While ChatGPT offers convenience, it also engenders adverse consequences for scientific research and creates ethical dilemmas in science and technology (Dignum, 2018; Thorp, 2023). Furthermore, despite the luxury of technological advancement, there are certain associated risks and difficulties. In his science fiction novel *The Three-Body Problem*, Liu Cixin skillfully depicts the conflict between technology and civilization, showcasing the negative outcomes of technological progress, such as the improper use of technology leading to societal collapse (Liu and Martinsen, 2015; Liu and Martinsen, 2016). The transmission of cultural traits across generations shapes the process of economic development (Spolaore and Wacziarg, 2013). Therefore, it is essential to prioritize fundamental human values and ethics as we make advancements in science and technology. This is crucial to prevent any potential harm to the interests and dignity of society, businesses, and individuals that may arise from the progress of science and technology. The interaction between culture and the economy impacts human behavior, necessitating the simultaneous promotion of technology and culture to achieve sustainable growth and overall progress for humanity.

As a driving force for economic and social development, enterprise development is inextricably linked to technological development (hard power) and the formation of enterprise culture (soft power) (Malecki, 2002). Corporate culture and technical innovation are essential elements that contribute significantly to a company's core competitiveness and ensure its long-term sustainability (Yang and Wang, 2022). However, many businesses prioritize the allocation of money and attention towards technology breakthroughs rather than cultural development (Brown and Ulijn, 2004). At the same time, Graham et al. (2022) surveyed that 92% of 1348 CEOs from North America believe that corporate culture results in increasing the com-

pany worth . Guiso et al. (2015) demonstrated that corporate culture serves to both enforce desired employee behavior and reduce the occurrence of employee moral hazard. Therefore, companies should focus on culture-building and strengthen the cultivation and enhancement of soft power to achieve sustainable growth and a competitive advantage. To properly integrate soft and hard power resources, doing so is more than a matter of choice. Mutual growth of culture and technology was vital at the enterprise level for enhancing innovation and competitiveness, as well as an important foundation for shaping a company's core competitiveness.

As a representation of a company's hard power, information technology (IT) has long been viewed as a significant driving force for productivity (Chang and Gurbaxani, 2013), especially in today's digital transformation context. Prior research has primarily examined various factors that impact the relationship between a company's investments in IT and its overall performance. These factors include internal aspects of the firm, such as its IT and organizational capabilities (Mithas et al., 2011), as well as the influence of IT on the firm's structure (Pan et al., 2023). Additionally, external factors such as consumer acceptance and utilization of IT have also been considered (Venkatesh et al., 2012). However, corporate culture, considered the cornerstone of enterprise development, has long been excluded from the theoretical framework exploring this relationship. This research gap not only limits academic understanding of the mechanisms through which corporate IT investments operate but also leaves enterprises undergoing digital transformation without theoretical guidance for aligning cultural and technological elements. Consequently, firms struggle to optimize the efficacy of IT investments, resulting in resource waste and transformation challenges. To address this deficiency, this study employs a sample of Chinese manufacturing listed companies from 2013 to 2022 to investigate the moderating role of corporate culture in the relationship between IT investment and organizational performance. This research serves dual purposes: bridging critical theoretical gaps while providing actionable insights for enterprises pursuing high-quality digital transformation.

The core contributions of this study are twofold. First, it pioneers the integration of corporate culture into the research framework of enterprise IT investment and performance, analyzing its moderating mechanisms through the dual lenses of cultural intensity and dimensionality. This breakthrough extends beyond the traditional focus on technological and organizational factors, enriching digital transformation theory by introducing cultural variables. Second, by embedding cultural considerations into technological investment decision-making, this research not only mitigates the adverse effects of excessive technocentrism but also guides organizations to enhance investment effectiveness through "culture-technology" synergy. This approach fosters a paradigm shift in digital transformation, transitioning from a "technology-driven" to a "culture-technology integrated" models.

2. Literature Review and Hypothesis Development

2.1 The Impact of Corporate IT Investments on Business Performance

Given the rapid advancement of IT, companies worldwide are actively participating in digital transformation and making significant investments in and use of IT. Digital transformation not only improves sales and productivity (Baldwin, 2018; Mithas et al., 2012), but also alters the operational strategies of companies (Schwertner, 2017). Companies may use digital technology to modify their products, processes, and corporate structures to effectively adapt to market fluctuations and meet customer demands (Matt et al., 2015). These improvements could help organizations better adapt to market competition and offer upgraded products and services (Kleis et al., 2012). Investing in IT leads to enhanced productivity and innovation. Due to the importance of IT in driving future economic competition (Bakos and Treacy, 1986; Lee et al., 2018), both government and corporate entities have increased their investment and efforts in its development (Gu et al., 2021; Tallon et al., 2019).

Currently, researchers are conducting numerous studies to investigate the impact of corporate IT investment on business performance. However, the substantial investment, lengthy implementation process, elevated risk of failure, and demanding maintenance and training skill prerequisites associated with IT investment have sparked an ongoing scholarly discussion regarding whether IT investment truly enhances business performance for organizations. Several studies have demonstrated that investments in IT have a substantial favorable impact on the performance of organizations (Chege et al., 2020; Pan et al., 2023). Additional research has indicated that when companies invest in IT, it does not lead to substantial improvements in their performance (Ortagus et al., 2018; Van Ark, 2016). In some cases, it may even have a detrimental impact on companies (Polák, 2017). Thus, academia lacks a universally acknowledged theoretical framework to elucidate the relationship between corporate IT investment and business performance.

Additionally, there are disparities in the research conducted by international and Chinese experts regarding the performance of IT investments. International researchers mostly examine firms in developed countries in Europe and the United States (Campbell, 2012), whereas Chinese scholars tend to concentrate on enterprises within a specific region or industry (Gu et al., 2021; Zeng and Lu, 2021). Furthermore, there is a dearth of validation studies conducted by international experts on underdeveloped countries. Chinese scholars' research on industrialized countries also lacked a thorough analysis and interpretation that took

into account the differences between them. International researchers have employed various approaches to validate or replicate research findings, whereas Chinese scholars have predominantly relied on regression analysis. The similarity in research methods and data across studies increases the likelihood of biased conclusions. Research conducted in developed countries mostly concentrates on three key areas: financial performance, stock market performance, and the operational performance of organizations. On the other hand, Chinese research primarily concentrates on financial success, leaving other areas less explored. Although there are variations, the majority of scholarly research indicates that investing in corporate IT has a beneficial effect on company performance. Therefore, the present study introduces the research hypothesis H1.

H1: Corporate IT investment has a positive impact on firm performance.

2.2 Moderating Effects of Corporate Culture Strength

Corporate culture encompasses the collective values and behavioral norms that exist within a company (Graham et al., 2022). Cultural transmission refers to the spread and continuation of shared ideas, rituals, traditions, and habits throughout different generations. A company's shared ideas shape its core attributes and cultivate a distinctive mindset that distinguishes it from competitors (Molenaar et al., 2002). Corporate culture includes various elements within a company, including norms, values, knowledge, and customs (Gorton et al., 2022). The combination of these traits creates a distinct cultural environment that influences several parts of the company, such as employee behavior, communication strategies, and decision-making processes (Schein, 2009). Research has further demonstrated that companies allocate resources to IT investments based on their corporate culture (Cronqvist et al., 2007; Davison and Martinsons, 2003; Harrington and Guimaraes, 2005). The fundamental values and principles of corporate culture have a significant impact on attitudes and decisions about the allocation of resources to IT expenditures. As a result, this influence affects the direction, scope, and methods used in implementing these investments. However, the implementation of IT investments also impacts the business culture. Investing in IT infrastructure enhances the quality and basic competitiveness of a company's culture by implementing cutting-edge technology and management approaches. Therefore, corporate culture and IT investment development have a linked and mutually influential relationship (Murphie and Potts, 2017), necessitating comprehensive research and investigation.

Currently, the inquiry into the relationship between IT investment and business culture in other nations is rather comprehensive and has yielded significant results. The main objective of this research is to examine the impact of IT investment on company culture and the reciprocal relationship between corporate culture and IT investment in industrial nations, specifically in Europe and the United States (Gallivan and Srite, 2005). Lyons et al. (2007) have shown that culture influences the degree of attention and dedication exhibited by members of a company towards IT investment. Also, they found that the decisions regarding IT investment made within the corporate culture may have a substantial effect on employee performance (Shamsudin and Velmurugan, 2023). Leidner and Kayworth (2006) did a research investigation. Interactions between diverse user groups and IT staff might result in cultural conflicts due to their contrasting values and IT values. Managers may reduce conflict by promoting a common set of IT values. However, gaps exist in current research. First, most studies are grounded in Western organizational contexts, lacking examination of emerging economies like China, where cultural characteristics (e.g., family-oriented values, relationship-centric practices, and government influence) may substantially modify the mechanisms linking IT investment to firm performance. Second, existing literature provides limited empirical exploration of how cultural intensity moderates the IT investment performance relationship, particularly through nuanced analysis of contextual boundary conditions. Moreover, the interplay between institutional factors (e.g., state policies) and culturally embedded organizational behaviors in shaping IT resource allocation decisions remains underexplored, creating critical knowledge gaps for both theoretical development and cross-cultural management practice.

Corporate culture in China demonstrates major differences in comparison to that of other countries. Traditional values heavily influence the culture, which prioritizes the significance of family (Combs et al., 2020). Family members play crucial roles in the organization. This familial position leads to a narrower power structure and decision-making process within Chinese institutions. Generally, family members play significant roles in management, with elder family members frequently shaping and influencing key decisions. Chinese corporate culture highly values interpersonal relationships and social networks (Flora Hung, 2004). Chinese organizations may exhibit a "guanxi" culture, which may lead to managerial employees participating in extra-role activities (Zhou et al., 2020). Similarly, the Chinese government wields a substantial impact on the corporate culture of Chinese enterprises (Tang and Li, 2009). Government regulations greatly influence the expansion of enterprises, their market entry capabilities, and the competitive landscape. These factors have a significant impact on a firm's decision-making processes and operational strategies.

Cultural diversities are unavoidable, yet they can impact the productivity or efficacy of a firm (Adamczyk, 2017). China's state-owned businesses (SOEs) strive to both generate earnings and fulfill their responsibilities to society by ensuring employment stability (Lin et al., 2020). Therefore, when it comes to investing in IT and developing

infrastructure, companies may also take into account other factors, such as improving working conditions for their employees or generating more job possibilities for the wider society. The comprehensive analyses of Chinese corporate culture have deepened our comprehension of Chinese organizations while confirming the distinctions between Chinese and Western corporate cultures. This paper presents the research hypothesis H2, which is based on the previously conducted study.

H2: Corporate culture intensity positively moderates the relationship between corporate IT investment and firm performance.

2.3 Moderating Effects of Corporate Culture Dimensions

Business culture commonly views innovation, honesty, and trust as distinctive components (Bao et al., 2024; Frankel, 2005). Maslow (1943) introduced a theory that hierarchically organizes five distinct types of needs. The hierarchy progresses in a step-by-step manner, starting with the fulfillment of fundamental physiological requirements and culminating in the satisfaction of psychological needs. Furthermore, this progression extends beyond material needs to spiritual needs. This theory provides a theoretical justification for our understanding of the complex process of constructing corporate culture. Utilizing Maslow's hierarchy of needs theory, we propose a three-level framework of corporate culture, known as the Financial, Strategic, and Value (FSV) corporate culture model (Wang, 2014). The concept categorizes corporate culture into three distinct levels: the financial level, the strategy level, and the value level. The financial level serves as the fundamental basis for establishing corporate culture. This level primarily emphasizes the economic prowess and material infrastructure of the firm, which are essential to ensuring the long-term and steady development of enterprise culture. Furthermore, the strategic level undergoes constant refinement and enhancement as corporate strategic goals are achieved. By establishing precise strategic objectives and embracing cultural concepts, the firm can effectively maintain its dominant position during intense market competition. The value-level culture is the fundamental aspect of company culture, encompassing creativity, integrity, and trust across the entire organization.

The emergence of the information economy and the rapid advancements in technology, along with the growing global rivalry, have highlighted the significance of innovation in company strategy (Gilbert, 1994). Innovation has a crucial role in enabling enterprises to attain sustained growth, establish a competitive edge (Igartua et al., 2010), and mold their organizational structures (Hogan and Coote, 2014). In a progressively competitive environment, companies use innovation as a strategy to explore new avenues of expansion by developing, optimizing, and integrating resources. Corporate culture influences the innovative behavior of firms (Naranjo-Valencia et al., 2016). Empirical research consistently demonstrates that a corporate culture of innovation has a favorable effect on business performance (Aksoy, 2017; Tang et al., 2020). Nevertheless, certain research has indicated that the correlation between the culture of corporate innovation and the performance of a corporation could be feeble or even adverse (Tarafdar et al., 2015). These diverse findings indicate that the connection between corporate innovation culture and company performance is intricate, and there may exist numerous unidentified aspects that require further comprehensive investigation and exploration. The FSV corporate culture hypothesis posits that innovation is a fundamental component that mirrors corporate ideals. Consequently, this article introduces hypothesis H3a.

H3a: The degree of corporate innovation culture positively moderates the relationship between corporate IT investment and firm performance.

Integrity is an essential component of corporate culture and plays an important role in a firm's long-term success and expansion (Koehn, 2005). Peng and Wei (2020) discovered that when management showed greater integrity, employees were more inclined to express their opinions. In their study, Guiso et al. (2015) found that 85% of companies in the Standard & Poor's 500 (S&P 500) had a corporate culture. Among these organizations, 80% emphasized the importance of innovation, while 70% highlighted the significance of integrity. An organizational culture that prioritizes corporate integrity influences the conduct and principles of its personnel, resulting in decreased costs associated with coordinating company strategies. A firm invests in corporate integrity to prevent potential violations or ethical lapses, thereby avoiding fines (Fuerst and Luetge, 2023).

The influence of corporate culture on business performance is significant (Kotter and Heskett, 1992). A strong corporate integrity culture is critical in business operations because it reduces the company's external transaction costs (Jiang et al., 2019) and enhances operational efficiency and performance levels. Companies that possess a culture of integrity not only demonstrate outstanding corporate social responsibility (CSR) performance (Wan et al., 2020), but also have the potential to generate higher profits (Hsu, 2007). On the other hand, companies that lack strong ethical values are more likely to encounter issues with safety inspections and financial restatements (Altamuro et al., 2022). The FSV corporate culture hypothesis posits that integrity is a fundamental component that mirrors corporate ideals. Therefore, this paper suggests hypothesis H3b.

H3b: The degree of corporate integrity culture positively moderates the relationship between corporate IT investment and firm performance.

The process of relational interaction, which revolves around customer trust, significantly influences the establishment of commercial connections. This, in turn, plays a crucial role in shaping customer loyalty towards a brand

(Sharma et al., 2020). When evaluating brand trust, people closely observe the actions and behavior of companies that hold the brand, particularly their ethical conduct towards consumers. This includes the company's commitment to integrity, which is a crucial factor in establishing trust (Mal et al., 2018). The internal trust culture of a firm has a significant role in influencing external perceptions and shaping the firm's image (VanDerMerwe and Puth, 2014). A culture of corporate trust, established within an organization's internal governance, promotes mutual trust between employees and the organization, fostering teamwork and effective communication. This, in turn, leads to substantial enhancements in organizational performance (Audi et al., 2016). Within the context of external transactions, this culture efficiently decreases the expenses associated with supervision, information search, and information imbalance, resulting in the optimization and reduction of transaction costs (Jiang et al., 2019). This culture significantly bolsters the market competitiveness of enterprises.

Furthermore, a corporate culture that fosters trust significantly affects a company's day-to-day actions and indirectly influences its decisions about IT investments (Dovey, 2009). Corporate trust fosters the sustainable development of an organization by promoting self-awareness and fostering innovation (Zhang et al., 2022). On the other hand, a corporate culture based on moral contracts fosters a trust atmosphere that strengthens adherence to behavioral standards and moral boundaries within the firm (Husted, 1998), thereby facilitating the alignment and elevation of organizational values. Finally, the corporate culture of trust encourages and limits one another, shapes the behavioral tendencies and value systems of corporate leaders and staff, and improves overall corporate performance. According to the FSV corporate culture hypothesis, trust is one of the core elements that embody corporate values, so this paper presents the H3c assumption.

H3c: The degree of corporate trust culture positively moderates the relationship between corporate IT investment and firm performance.

3. Sample Selection and Research Method

3.1 Sample

This study involved screening the original research sample of A-share manufacturing listed businesses in China from 2013 to 2022. The screening process included rejecting samples of ST and *ST enterprises, as well as samples with missing values for variables such as firm performance and firm IT investment. We ultimately acquired a total of 35,449 firm-year observations. We manually collect information from the Internet on the three aspects of corporate culture, namely organizational structures, internal constructions, and social relations. We have obtained a total of 4526 observations from different firms. We use the China Stock Market & Accounting Research Database (CSMAR) to gather information on many aspects of business performance, including firm size, time to market, asset-liability ratio, largest shareholder shareholding ratio, top ten shareholders' ownership ratio, as well as time, industry, and provincial dummy variables. This paper employs the shrink-tail (Winsor) processing method in the regression analysis to mitigate the impact of outliers on the research findings. This method involves shrinking all continuous variables to the 1% and 99% quantiles. Additionally, to address multicollinearity, this paper centers on the independent variables and the moderator variables.

3.2 Varibles

Dependent variable. The dependent variable is firm performance (TQ). Referring to the research of Bharadwaj et al. (1999), this paper uses Tobin's Q value of market performance measurement index to measure enterprise performance. The use of Tobin's Q as a measure of corporate performance is methodologically justified. Calculated as the ratio of a firm's market value to the replacement cost of its assets, Tobin's Q effectively captures the firm's future growth potential and investor expectations. This metric is widely accepted in strategic management research, particularly for evaluating the long-term value implications of strategic resources such as IT investments.

Independent variable. The independent variable is firm IT investment (IT). This paper divides enterprise IT investment into two parts: IT hardware investment (Device) and IT Software investment (Software). Device is a variety of physical assets used to store, process, process and transmit information, such as computers, servers and network equipment. Software refers to the investment in various applications and software in computer systems.

The specific calculation formula is shown in Eqn. 1:

$$\mathrm{IT} = \mathrm{Device} + \mathrm{Software} \tag{1}$$

Moderating variable. The moderating variables are corporate culture Strength (Strength), corporate Innovation (Innovation), corporate Integrity (Integrity) and corporate Trust (Trust).

Strength. Existing studies typically utilize survey questionnaires to assign scores to corporate culture (Kotter and Heskett, 1992; Sørensen, 2002). However, the causal relationship established between performance and cultural ratings may be questionable due to "self-serving bias". This bias implies that employees tend to attribute corporate success to themselves, while blaming failures on external factors such as culture (Martinko and Gardner, 1987), thereby leading to a reverse causality issue—where performance levels may inversely affect the rating outcomes. To overcome this methodological limitation, this paper draws on the approach of Wang and Kan (2014) and adopts a perspective centered on organizational behavioral characteristics to construct more objective metrics for measuring culture. We

gathered publicly available data from 4526 publicly traded companies. We assessed the quality of corporate culture using three dimensions: organizational system (OS), internal construct (IC), and social interactions (SR). We conducted an analysis to determine if the company effectively communicated its fundamental vision, culture, and strategic objectives through corporate announcements, corporate websites, and other public channels, accurately reflecting the current state and attributes of the company's culture at the organizational level. We investigated whether the company provided corporate culture training to its employees, assessing the degree of internalization and potential influence on their behavior. We evaluated if the firm has engaged in any significant media promotion to determine if its core culture has become a well-known brand culture in the public domain. If any of the aforementioned levels of corporate culture performance exist, the assigned value for the level is 1; otherwise, the assigned value is 0. We combine the values of the three layers of corporate culture to calculate a comprehensive measure of corporate culture's strength. This specific calculation formula is Eqn. 2.

$$\text{Strength} = \text{OS+IC+SR} \tag{2}$$

Innovation. This study uses the Innovative Input to Revenue from Main Operations, as proposed by Wang (2014), as a metric for assessing the fundamental culture of innovative values in M&A. For our research and development (R&D) analysis, we utilized comprehensive indicators derived from the annual reports of publicly traded companies. These indicators included the current level of development spending, the amount of R&D investment recorded as intangible assets on the balance sheet, and the R&D expenses listed under administrative expenses in the income statement. The precise calculation formula is displayed in Eqn. 3:

$$\text{Innovation} = \text{Innovation Input / Revenue from Main Operations} \tag{3}$$

Integrity. This study, based on the Wang (2014) research, examines the content of firms' annual reports to determine if they have been involved in any new lawsuits as the defendant (Integrity1). A value of 1 is assigned if they have, and 0 if they have not. Additionally, we investigate whether there are any penalties included in the non-operating expenditures (Integrity2). Again, a value of 1 is assigned if there are penalties, and 0 if there are not. The quality of the disclosure is evaluated and rated as excellent (A = 0), good (B = 1), passing (C = 2), or poor (D = 3) (Integrity3). Finally, we record whether executives have faced public punishment or condemnation (Integrity4), marking 1 if they have and 0 if they have not. The firm's culture of integrity can be determined by summing together the four variables mentioned above. Smaller values indicate a higher level of excellence. The precise calculation formula is displayed in Eqn. 4:

$$\text{Integrity} = \text{Integrity 1} + \text{Integrity 2} + \text{Integrity 3} \tag{4}$$

Trust. This study employs the text analysis method to measure the trust culture within organizations, drawing inspiration from Jiang et al. (2015) research. Initially, we discerned the words associated with the concept of "trust". During the second phase, we established the extent of the search for pertinent terms. During the third phase, we conducted a thorough manual search of several sources, including the company's annual report, internal control report, profile, culture section, official homepage, news stories, and speeches given by the CEO or chairman in interviews and annual meetings. We aimed to identify any references to the word "trust". In the fourth phase, we conclude that the company has a corporate culture of trust if it incorporates any of the aforementioned terms, assigning trust a value of 1; otherwise, we assign it a value of 0.

Control variables. In order to analyze the potential impacts on the performance of firms' IT investments, the following control variables were selected: firm size (Size), enterprise's listing time (Age), asset-liability ratio (Lev), largest shareholder ownership (TOP1), top ten shareholder ownership (TOP10), industry dummy variable (Industry), and year dummy variable (Year).

All variables in use are listed in Table 1.

3.3 Method

This article aims to examine the influence of corporate IT investment on business performance and the role of corporate culture in moderating this relationship. To accomplish this, the paper formulates the following model: To account for the time delay between IT investment and performance enhancement in firms, this study introduces a lag of one period to the dependent variable in Eqn. 5 to mitigate the potential issue of reverse causality. We consider factors such as firm size, enterprise's listing time, asset-liability ratio, share proportion of the largest shareholder, and share proportion of the top 10 shareholders, all of which have the potential to impact both the independent and dependent variables. The regression analysis includes industry-specific fixed effects and year-specific fixed effects to account for the influence of these factors. In methodological terms, the fixed-effects model provides a more rigorous framework for addressing common challenges in corporate research. By controlling for industry and year fixed effects, this approach effectively neutralizes confounding influences from sector-specific characteristics and macroeconomic fluctuations, thereby mitigating omitted variable bias. Compared to the random-effects model, the fixed-effects specification relaxes the stringent exogeneity as-

Table 1. Definition of variables.

Variable type	Variable name	Symbol	Variable description
Dependent variable	Enterprise Performance	TQ	Ratio of market capitalization to total assets
Independent variable	Enterprise IT Investment	IT	The sum of IT hardware investment and IT software investment takes the natural logarithm
Moderating variables	Corporate Culture Strength	Strength	Sum of organizational system, internal structure and social relations
	Enterprise Innovation Culture Degree	Innovation	Ratio of innovation investment to main business revenue
	Corporate Integrity Culture	Integrity	Sum of lawsuits, penalties, disclosures, and reprimands of executives
	Corporate Trust Culture	Trust	The related terms with "trust" element take 1, otherwise take 0
Control variables	Enterprise size	Size	Natural logarithm of total assets at the end of the year
	Enterprise's listing time	Age	The natural logarithm of the number of years a company has been listed as of the end of the year, plus one
	Asset-liability ratio	Lev	Ratio between total liabilities and total assets at the end of the year
	Shareholding ratio of the first largest shareholder	TOP1	Ratio between the number of shares held by the first largest shareholder and the total number of shares of the company at the end of the period
	Shareholding ratio of top ten shareholders	TOP10	Ratio between the number of shares held by the top ten shareholders and the total number of shares of the company at the end of the period
	Industry	Industry	Industry dummy variables
	Year	Year	Year dummy variable

IT, Information Techonology.

Table 2. Descriptive statistics of variables.

Variable	Sample size	Mean	Median	Standard deviation	Minimum	Maximum
TQ	26,908	2.094	1.654	1.382	0.849	9.071
IT	26,908	2.684	0.483	6.919	0.002	48.530
Strength	26,908	2.066	2.000	0.641	0.000	3.000
Innovation	23,709	0.152	0.039	12.270	0.000	1860.000
Integrity	26,908	2.239	2.000	1.387	0.000	4.000
Trust	26,908	0.893	1.000	0.309	0.000	1.000
Size	26,908	22.200	22.020	1.276	19.870	26.150
Age	26,908	2.696	2.708	0.557	1.386	3.497
Lev	26,908	0.415	0.403	0.207	0.056	0.934
TOP1	26,908	33.820	31.460	14.720	8.448	74.240
TOP10	26,908	59.180	60.160	15.020	24.120	90.370

sumptions regarding explanatory variables, making it particularly suitable for analyzing corporate data with inherent self-selection biases and nested structures. This modeling strategy enhances internal validity by accounting for time-invariant firm-specific heterogeneities that might otherwise confound the relationship between IT investments, cultural moderators, and organizational performance outcomes.

$$\text{TQ}_{i,t+1} = \alpha_0 + \alpha_1 \text{IT}_{i,t} + \alpha_2 \text{IT}_{i,t} * \text{Culture}_{i,t} + \alpha_3 \text{Controls}_{i,t} + \varepsilon_1 \quad (5)$$

In Eqn. 5, $\text{TQ}_{i,t+1}$ represents the performance of firm i in year $t+1$, $\text{IT}_{i,t}$ represents the IT investment of firm i in year t, $\text{Culture}_{i,t}$ represents the cultural intensity of firm i in year t, $\text{Controls}_{i,t}$ is the control variable, and ϵ_1 is the residual term.

4. Empirical Testing and Analysis of Results

4.1 Descriptive Statistics and Correlation Analysis

4.1.1 Descriptive Statistics

Table 2 presents an analysis of the descriptive statistics for the primary variables in the regression sample. Table 2 reveals that the average corporate performance is 2.094, with a minimum value of 0.849 and a maximum value of 9.071. This indicates a notable disparity in IT investment success among various listed businesses. The mean value for corporate IT investment is 2.684, with a minimum value of 0.002 and a maximum value of 48.53. This suggests that there is a notable disparity in the level of IT expenditure among various listed firms. The mean value for corporate culture is 2.066, suggesting that Chinese-listed companies generally have a strong corporate culture.

Table 3. Pearson correlation coefficient analysis of the main variables.

Variable	TQ	IT	Strength	Innovation	Integrity	Trust	Size	Age	Lev	TOP1	TOP10
TQ	1.000										
IT	–0.099***	1.000									
Strength	0.064***	–0.090***	1.000								
Innovation	0.001	–0.003	0.022***	1.000							
Integrity	–0.780***	0.136***	–0.117***	–0.006	1.000						
Trust	0.283***	–0.186***	0.115***	0.003	–0.440***	1.000					
Size	–0.369***	0.455***	–0.157***	–0.006	0.483***	–0.465***	1.000				
Age	–0.013**	0.162***	–0.411***	–0.016**	0.096***	–0.237***	0.398***	1.000			
Lev	–0.221***	0.180***	–0.173***	0.004	0.325***	–0.255***	0.485***	0.360***	1.000		
TOP1	–0.122***	0.049***	0.071***	0.011*	0.144***	–0.113***	0.177***	–0.024***	0.026***	1.000	
TOP10	–0.111***	0.042***	0.223***	0.012*	0.111***	–0.041***	0.083***	–0.347***	–0.128***	0.623***	1.000

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Pearson two-sided test.

Table 4. The effect of corporate culture intensity on the relationship between corporate IT investment and corporate performance.

	Explained Variables: TQ		
	Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)
Constant	3.877*** (0.877)	4.050*** (0.896)	4.048*** (0.896)
IT		0.057** (0.023)	0.061*** (0.023)
Size	–0.067* (0.041)	–0.079* (0.042)	–0.079* (0.042)
Age	0.000 (.)	0.000 (.)	0.000 (.)
Lev	–0.359*** (0.132)	–0.352*** (0.132)	–0.352*** (0.132)
TOP1	–0.004* (0.002)	–0.004* (0.002)	–0.004* (0.002)
TOP10	–0.004* (0.002)	–0.004* (0.002)	–0.004* (0.002)
Strength		0.081*** (0.028)	0.084*** (0.028)
IT*Strength			0.010** (0.005)
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observations	21,437	21,437	21,437
R^2	0.186	0.186	0.187
Adjusted R^2	0.185	0.186	0.186

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.1.2 Table of Pearson's Correlation Coefficients for Variables

Table 3 shows the Pearson correlation coefficients between the variables in the regression model. This table reveals a negative correlation between corporate IT investment and corporate performance at the 1% level of significance. In addition, in Table 3, the maximum absolute value of the correlation coefficient between all independent, dependent, and control variables two by two is 0.78, indicating that there is no serious problem of covariance between the variables.

4.2 Regression Analysis Results

4.2.1 Corporate Culture Strength

Through a thorough analysis of the literature, we have determined that the investment in IT by Chinese companies has a positive impact on their overall performance. Further investigation revealed that the intensity of corporate culture can effectively control the performance of corporate IT investments. In other words, the more intense the corporate culture, the greater the positive influence of corporate IT investments on the company's performance. Table 4 illustrates how the intensity of corporate culture influences the correlation between corporate IT investment and firm performance. We included the control variables in the second column of the regression model, the independent variables in the third column, and the interaction term in the fourth column. When the independent variables are incorporated into the regression analysis, it is observed that corporate IT investment has a statistically significant positive impact on firm performance ($\beta = 0.057$) at a significance level of 5%. This suggests that a one-standard deviation increase in corporate IT investment will lead to a 0.057-standard deviation increase in firm performance, assuming the values of the corresponding sample means remain constant. This finding supports our hypothesis H1. Using the regression results of the interaction term, we find that the relationship between the amount of money spent on IT by a company and the level of culture within that company has a positive effect on the performance of that company, with a significance level of 5% ($\beta = 0.010$). This confirms our proposed hypothesis H2.

This study confirms the strategic value of IT investments in the Chinese context, where they directly improve firm performance while creating synergistic effects through interactions with organizational systems, cultural values, and social relations. Firms should implement integrated technology-culture strategies by assessing cultural-digital alignment during IT planning. Importantly, digital transformation requires organizational cultural evolution alongside technological upgrades. These findings highlight that successful digitalization demands parallel progress in both technical and cultural dimensions.

4.2.2 Degree of Corporate Innovation Culture

Our analysis of the literature has determined that the level of corporate innovation culture has a direct influence on the effectiveness of corporate IT investment. In other words, the stronger the corporate innovation culture, the greater the positive effect of IT investment on company performance. Table 5 illustrates how the level of corporate innovation culture influences the relationship between corporate IT investment and company performance. The regression model includes the addition of control variables in the second column, independent variables in the third column, and an interaction term in the fourth column. After including the independent variables in the regression analysis, we find that corporate IT investment has a statistically signifi-

Table 5. The effect of the degree of corporate innovation culture on the relationship between corporate IT investment and corporate performance.

	Explained Variables: TQ		
	Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)
Constant	3.877*** (0.877)	1.914*** (0.502)	1.914*** (0.502)
IT		0.040** (0.020)	0.040** (0.020)
Size	–0.067* (0.041)	0.021 (0.023)	0.021 (0.023)
Age	0.000 (.)	0.000 (.)	0.000 (.)
Lev	–0.359*** (0.132)	–0.415*** (0.084)	–0.415*** (0.084)
TOP1	–0.004* (0.002)	–0.005*** (0.002)	–0.005*** (0.002)
TOP10	–0.004* (0.002)	–0.003* (0.001)	–0.003* (0.001)
Innovation		0.016 (0.083)	0.016 (0.083)
IT*Innovation			0.000 (0.004)
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observations	21,437	18,954	18,954
R^2	0.186	0.191	0.191
Adjusted R^2	0.185	–0.011	–0.011

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

cant positive impact on firm performance at the 5% significance level (β = 0.040). Keeping all other variables constant and assuming the values of the corresponding sample means, this implies that a one-standard deviation increase in corporate IT investment will lead to a 0.040 standard deviation increase in firm performance. This finding confirms our hypothesis H1. Upon incorporating the interaction term into the regression analysis, we observe that the link between the interaction term of corporate IT investment and the degree of corporate innovation culture and corporate performance is not statistically significant. This finding contradicts our proposed hypothesis H3a.

This outcome is best interpreted within China's unique socio-cultural context. On the one hand, many firms' R&D decisions are strongly influenced by government industrial policies and development plans. Their innovation investments frequently reflect non-market motivations—such as responding to policy directives, obtaining fiscal subsidies, or cultivating a government-aligned corporate image—which diverge from a genuinely market-driven innovation culture that encourages risk-taking and tolerates failure. On the other hand, the deeply embedded network of guanxi in China's business environment functions as an informal institution that often overrides or circumvents efficiency-oriented formal rules (North, 1990), thereby impairing the allocation of innovation resources. This phenomenon is particularly pronounced in SOEs, where CEOs with strong political promotion incentives tend to prioritize scale-oriented investments that generate short-term visible outcomes over high-risk, long-cycle substantive innovation (Bo et al., 2023). As a result, IT investment—a critical enabler of innovation that should be closely integrated with high-potential R&D projects—is often misallocated under the influence of guanxi. This leads to a disconnect between advanced technological systems and high-quality innovative ideas, ultimately undermining the catalytic role that a dynamic innovation culture can play.

4.2.3 Degree of Corporate Integrity Culture

Through our analysis of the literature, we have determined that the level of corporate integrity culture has the ability to effectively control the impact of corporate IT investment on corporate performance. In other words, the stronger the degree of corporate integrity culture, the more significant the positive influence of corporate IT investment on corporate performance. Table 6 illustrates how the level of corporate integrity culture influences the relationship between corporate IT investment and firm performance. The regression model incorporates more variables in each subsequent column: control variables in the second column, independent variables in the third column, and an interaction term in the fourth column. When the independent variables are incorporated into the regression analysis, it is observed that corporate IT investment has a statistically significant positive impact on firm performance at the 10% significance level (β = 0.031). This implies that if corporate IT investment increases by one standard deviation of the sample while keeping all other variables constant at their respective sample means, it will lead to a corresponding increase of 0.031 standard deviations in firm performance. This finding confirms our hypothesis (H1). By incorporating the regression findings of the interaction term, we observe that the interaction between corporate IT investment and corporate integrity culture has a statistically significant positive impact on firm performance at a significance level of 5% (β = 0.009), hence confirming our proposed hypothesis H3b.

Research demonstrates that organizational culture significantly influences business management practices. Em-

Table 6. The effect of the degree of corporate integrity culture on the relationship between corporate IT investment and corporate performance.

	Explained Variables: TQ		
	Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)
Constant	3.877*** (0.877)	4.550*** (0.444)	4.550*** (0.444)
IT		0.031* (0.018)	0.031* (0.018)
Size	–0.067* (0.041)	0.110*** (0.021)	0.110*** (0.021)
Age	0.000 (.)	0.000 (.)	0.000 (.)
Lev	–0.359*** (0.132)	–0.331*** (0.071)	–0.331*** (0.071)
TOP1	–0.004* (0.002)	–0.002 (0.002)	–0.002 (0.002)
TOP10	–0.004* (0.002)	–0.003** (0.001)	–0.003** (0.001)
Integrity		–0.315*** (0.009)	–0.315*** (0.009)
IT*Integrity			0.009** (0.004)
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observations	21,437	21,437	21,437
R^2	0.186	0.243	0.243
Adjusted R^2	0.185	0.070	0.070

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. The effect of the level of corporate trust culture on the relationship between corporate IT investment and corporate performance.

	Explained Variables: TQ		
	Coefficient (t-value)	Coefficient (t-value)	Coefficient (t-value)
Constant	3.877*** (0.877)	4.099*** (0.453)	4.099*** (0.453)
IT		0.057*** (0.018)	0.057*** (0.018)
Size	–0.067* (0.041)	–0.079*** (0.021)	–0.079*** (0.021)
Age	–0.359*** (0.132)	–0.355*** (0.074)	–0.355*** (0.074)
Lev	–0.004* (0.002)	–0.004** (0.002)	–0.004** (0.002)
TOP1	–0.004* (0.002)	–0.004*** (0.001)	–0.004*** (0.001)
TOP10	–0.359*** (0.132)	–0.355*** (0.074)	–0.355*** (0.074)
Trust		0.021 (0.029)	0.021 (0.029)
IT*Trust			0.000 (0.004)
Industry	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observations	21,437,000	21,437,000	21,437,000
R^2	0.186	0.186	0.186
Adjusted R^2	0.185	0.000	0.000

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

pirical analysis reveals a substantial positive moderating effect of integrity culture on IT investment performance, which not only introduces new methodologies for cultural quantification but also advances the field's transition from theoretical discourse to empirical validation. From a practical standpoint, this finding underscores the necessity for investors to consider cultural soft factors in decision-making processes. For enterprises, strengthening integrity culture can optimize IT investment returns and enhance competitive advantages. At the policy level, this conclusion provides a foundation for governmental strategies-by promoting corporate integrity culture development, policymakers can improve market environments, thereby fostering IT innovation and driving high-quality economic growth.

4.2.4 Degree of Corporate Trust Culture

Through an examination of the literature, we have determined that the level of trust within a company's culture has the ability to effectively control the impact of corporate IT investment on overall corporate performance. In other words, the greater the level of trust within the company's culture, the more significant the positive influence of corporate IT investment on corporate performance. Table 7 illustrates how the level of trust within a company's culture influences the correlation between investments in corporate IT and the firm's overall performance. The regression model includes the addition of control variables in the second column, independent variables in the third col-

umn, and an interaction term in the fourth column. After including the independent variables in the regression analysis, we find that corporate IT investment has a statistically significant positive impact on firm performance at the 1% level of significance ($\beta = 0.057$). This implies that if corporate IT investment increases by one standard deviation of the sample while keeping all other variables constant at their respective sample means, it will lead to a corresponding increase of 0.057 standard deviations in firm performance. This finding confirms our hypothesis (H1). Upon incorporating the regression results of the interaction term, it is evident that the correlation between the interaction term of corporate IT investment, the degree of corporate trust culture, and corporate performance is not statistically significant. This finding does not provide support for our proposed hypothesis H3c.

The trust paradigm in Chinese society is characterized by what is known as the "differential mode of association", which fosters a form of particularistic trust grounded in consanguinity and geographical proximity (Fei et al., 1992). This model inherently conflicts with the universalistic trust culture—predicated on impartial rules and equal treatment—that is essential for the effective operation of IT systems. In business practice, particularly within family-owned enterprises, interpersonal trust predominates, whereas contractual trust remains underdeveloped (Shi et al., 2015). Although "trust" is frequently emphasized in corporate rhetoric, it often serves as a tool for impression management rather than reflecting an institutionalized reality. Consequently, IT initiatives promoting process transparency and data sharing often meet with implicit resistance, manifesting as departmental silos and the withholding of information, as employees perceive transparency as a threat to the power and resources derived from private networks. For example, in the implementation of Enterprise Resource Planning (ERP) systems, cultural and environmental factors not only directly hinder success but also indirectly exacerbate technical challenges (Xue et al., 2005). Thus, superficially endorsed "trust" is insufficient to overcome the deep-seated resistance embedded in the particularistic trust structure, and it fails to effectively moderate the relationship between IT investment and organizational performance.

5. Heterogeneity Test and Robustness Test

5.1 Heterogeneity Test

5.1.1 Overseas Backgrounds of Corporate Executives

In order to analyze the impact of executive teams with international experience on business performance, we categorize publicly traded companies based on whether their executive teams have overseas backgrounds and then carry out controlled experiments. Research conducted by Maznevski and DiStefano (2000) and Karahanna and Preston (2013) indicates that CEOs who have studied or worked abroad have lower levels of self-confidence, and this is closely linked to the long-term performance of their firms. Thus, it is logical to propose that the international experience of a company's executive team could impact the connection between a company's investment in IT and its overall performance.

We collected data for the variable "Overseas background of executive team" (Oversea) from CSMAR. In this paper, we measured this variable in two steps. The initial stage involves determining the international background of every member of a company's executive team. We classify this background into three dimensions: the absence of any international experience, the experience of studying abroad, and the experience of working abroad. If the executive lacks international experience, this variable's value is 0. The value of this variable increases by 1 if an individual has studied abroad, this variable's value increases by 1. The value of this variable increases by 1 if an individual has international experience, this variable's value increases by 1. The second step entails calculating the mean value of the international experience possessed by all members of the company's executive team, which refers to the team's cumulative overseas background. To determine the overseas background of the executive team of the enterprise, the first step is to calculate the average value of the overseas background of all its members. The overseas background of the executive team of the enterprise was divided into two groups from low to high for the group control test, and the value interval of the variables in the first group was (0.09, 1.46], and the value interval of the variables in the second group was [0, 0.09].

We perform a group estimate and display the estimation outcomes in columns 2 and 3 of Table 8. In the high executive team overseas background group, it has been observed that corporate IT investment has a substantial positive impact on corporate performance at a statistically significant level of 1%. Additionally, corporate culture plays a positive role in moderating the relationship between corporate IT investment and corporate performance at the same level of significance. However, in the low executive team overseas background group, corporate IT investment does not have a significant impact on corporate performance, and corporate culture does not have a significant effect on the relationship between corporate IT investment and corporate culture. Company culture does not influence the relationship between corporate IT investment and business performance. The data above demonstrates that the effect of corporate IT investment on corporate success varies, and there is a notable disparity in the impact of corporate IT investment on corporate performance between the low and high executive team foreign background groups.

5.1.2 Academic Background of Corporate Executive Teams

To assess the influence of the educational qualifications of the executive team on the success of the company, we categorize the listed enterprises based on the educational

Table 8. Results of heterogeneous regression of the impact of the overseas background of enterprise executive teams on enterprise performance.

	Explained Variables: TQ	
	(1) High overseas background	(2) Low overseas background
Constant	5.031*** (1.060)	2.090 (1.648)
IT	0.055** (0.028)	0.062 (0.040)
Size	–0.131*** (0.050)	0.019 (0.075)
Age	0.000 (.)	0.000 (.)
Lev	–0.313* (0.171)	–0.348* (0.202)
TOP1	–0.004 (0.003)	–0.004 (0.004)
TOP10	–0.004* (0.002)	–0.003 (0.004)
Strength	0.107*** (0.035)	0.032 (0.048)
IT*Strength	0.015*** (0.002)	0.003 (0.003)
Industry	Yes	Yes
Year	Yes	Yes
Observations	13,466	7971
R^2	0.190	0.190
Adjusted R^2	0.189	0.188

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

background of their executive team and carry out a controlled experiment. We collect data on the "academic background" of the executive team from the CSMAR. This article measures the academic background of the executive team in two stages. The first stage entails assessing the educational qualifications of each executive team member in the organization. This assessment is based on three criteria: length of employment in colleges and universities; length of employment in scientific research institutes; and involvement in research associations. We set the variable's value to 0 if the executive lacks an academic background. The variable's value increases by 1 if the individual has prior experience in a university setting. The variable's value increases by 1 if the individual has prior experience in a research institution. The variable's value increases by 1 if an individual actively participates in research within an organization. The second phase entails calculating the mean academic qualifications possessed by all members of the company's executive team. Academic background is of significant importance. For the group control test, the executive team of the enterprise divides its academic background into two groups, ranging from low to high; the first group's value interval is (4.2, 1.9], while the second group's value interval is (0, 4.2].

A group estimate is performed, and the estimation outcomes are displayed in columns 2 and 3 of Table 9. In the high executive team academic background group, it has been discovered that corporate IT investment has a noteworthy positive impact on firm performance at a significance level of 1%. Additionally, corporate culture has a positive moderating effect on the relationship between corporate IT investment and firm performance at the same significance level. On the other hand, in the low executive team academic background group, corporate IT investment does not have a significant impact on firm performance, and corporate culture does not have a significant effect on the relationship between corporate IT investment and firm performance. The relationship between corporate IT investment and business performance is not influenced by company culture. The analysis above demonstrates that the effect of corporate IT investment on corporate performance varies, and there is a notable disparity in the impact of corporate IT investment on corporate performance between groups with low and high executive team academic backgrounds.

5.1.3 Enterprise High-Tech Level

Investing in corporate IT is crucial due to the substantial and consistent differences between high-tech and non-high-tech companies. For high-tech enterprises, success and long-term competitive advantage heavily rely on science and technology. It is worth investigating whether there is a major difference in the effect of corporate IT investment on business performance between these two types of firms. Consequently, we categorize the sample into high-tech and non-high-tech firm samples and analyze the influence of corporate IT expenditure on business performance in distinct samples.

We conduct a collective assessment and present the findings of the assessment in columns 2 and 3 of Table 10. We have found a significant and positive correlation between corporate IT investment and firm performance in the group of non-high-tech enterprises, with a significance level of 5%. Additionally, corporate culture plays a positive role in moderating the relationship between corporate IT investment and firm performance at the same significance level. However, in the group of high-tech firms, corporate IT investment does not have a significant effect on firm performance, and corporate culture does not have a significant

Table 9. Results of heterogeneous regression of the impact of the academic background of enterprise executive teams on enterprise performance.

	Explained Variables: TQ	
	(1) High academic background	(2) Low academic background
Constant	5.081*** (1.199)	2.100 (1.286)
IT	0.096*** (0.031)	0.023 (0.035)
Size	–0.133** (0.056)	0.022 (0.060)
Age	0.000 (.)	0.000 (.)
Lev	–0.330* (0.178)	–0.366* (0.198)
TOP1	–0.002 (0.003)	–0.006* (0.003)
TOP10	–0.003 (0.003)	–0.005* (0.003)
Strength	0.063* (0.037)	0.116*** (0.045)
IT*Strength	0.017*** (0.003)	0.003 (0.003)
Industry	Yes	Yes
Year	Yes	Yes
Observations	12,559	8872
R^2	0.170	0.214
Adjusted R^2	0.169	0.212

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10. Heterogeneous regression results of the impact of enterprise technical level on enterprise performance.

	Explained Variables: TQ	
	(1) High-tech enterprises	(2) Non-high-tech enterprises
Constant	2.251 (2.114)	4.168*** (1.022)
IT	0.086 (0.053)	0.066** (0.028)
Size	0.031 (0.098)	–0.095** (0.047)
Age	0.000 (.)	0.000 (.)
Lev	–0.152 (0.301)	–0.436*** (0.138)
TOP1	–0.011* (0.006)	–0.002 (0.002)
TOP10	–0.007 (0.005)	–0.002 (0.002)
Strength	0.051 (0.055)	0.098*** (0.033)
IT*Strength	0.119 (0.061)	0.009** (0.005)
Industry	Yes	Yes
Year	Yes	Yes
Observations	5185	16,252
R^2	0.199	0.187
Adjusted R^2	0.197	0.186

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

impact on the relationship between corporate IT investment and firm performance. Company culture does not influence the relationship between corporate IT investment and business performance. The analysis above demonstrates that the influence of enterprise technology level on enterprise performance varies, and there is a notable disparity in the effect of enterprise IT expenditure on enterprise performance between high-tech and non-high-tech enterprise groups.

5.2 Robustness Test

5.2.1 Addition of Province Dummy Variables

In the prior regression model, we included industry-fixed effects and time-fixed effects, but we did not include provincial-fixed effects. While the majority of enterprises remain in the same province, a tiny proportion of firms do relocate to a different province. Failure to consider significant characteristics in provinces that remain constant over time can lead to endogeneity issues and biased outcomes.

To address potential endogeneity issues, this research incorporates industry-fixed and temporal-fixed effects, while also placing greater emphasis on provincial-fixed effects. Columns 2 and 3 of Table 11 display the estimation results. Upon considering only industry-fixed effects and time-fixed effects, it becomes clear that corporate IT investment significantly boosts firm performance, reaching a statistically significant level of 1%. Corporate culture also has a positive moderating effect on the relationship between corporate IT investment and firm performance, with

Table 11. Consideration of omitted variables.

	Explained Variables: TQ	
	Regression analysis	Considering omitted variables
Constant	4.048*** (0.896)	3.548*** (0.969)
IT	0.061*** (0.023)	0.060*** (0.023)
Size	–0.079* (0.042)	–0.072* (0.042)
Age	0.000 (.)	0.000 (.)
Lev	–0.352*** (0.132)	–0.371*** (0.132)
TOP1	–0.004* (0.002)	–0.004* (0.002)
TOP10	–0.004* (0.002)	–0.004* (0.002)
Strength	0.084*** (0.028)	0.085*** (0.028)
IT*Strength	0.010** (0.005)	0.010** (0.005)
Industry	Yes	Yes
Year	Yes	Yes
Province	No	Yes
Observations	21,437	21,431
R^2	0.187	0.190
Adjusted R^2	0.186	0.188

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12. Shortened time window.

	Explained Variables: TQ	
	Regression Analysis	Shorten the time window
Constant	4.048*** (0.896)	6.559*** (0.814)
IT	0.061*** (0.023)	0.014* (0.034)
Size	–0.079* (0.042)	0.862*** (0.065)
Age	0.000 (.)	0.000 (.)
Lev	–0.352*** (0.132)	–0.417** (0.181)
TOP1	–0.004* (0.002)	0.005 (0.004)
TOP10	–0.004* (0.002)	–0.012*** (0.003)
Strength	0.084*** (0.028)	0.095*** (0.060)
IT*Strength	0.010** (0.005)	0.011** (0.007)
Industry	Yes	Yes
Year	Yes	Yes
Province	No	Yes
Observations	21,437	8426
R^2	0.187	0.112
Adjusted R^2	0.186	0.632

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

statistical significance at the 5% level. Even when more province-fixed effects are considered, the positive impact of corporate IT investment on firm performance remains significant at the 1% level, and the positive moderating effect of corporate culture on firm performance remains significant at the 5% level. When accounting for province-fixed effects, enterprise IT investment continues to have a significant positive impact on enterprise performance at a significance level of 1%. Additionally, enterprise culture still plays a positive moderating role in the relationship between enterprise IT investment and enterprise performance, with a significance level of 5%. The above research demonstrates that the data presented in this paper are resilient and reliable.

5.2.2 Shorten Time Window

Investing in IT is a crucial strategy for firms to accomplish digital transformation and enhance productivity. During exceptional situations, such as the Xinguang pandemic outbreak, expenditures in IT may not provide the anticipated improvement in corporate performance, as stated by Reuschl et al. (2022). This may result in the "IT productivity paradox".

Hence, this study chose the sample period from 2019 to 2022 for the regression analysis in order to eliminate the influence of policies implemented during the COVID-19 pandemic. Columns 2 and 3 of Table 12 display the estimation results. From 2013 to 2022, we observed a strong positive influence of corporate IT investment on firm performance at a statistically significant level of 1%. Additionally, we found a positive moderating effect of corporate culture on the relationship between corporate IT investment and firm performance, with statistical significance at the 5% level. Similarly, in the period from 2019 to 2022, corporate IT investment continued to have a significant positive impact on firm performance, although at a lower level of statistical significance (10%). The moderating effect of corporate culture on the relationship between corporate IT investment and firm performance remained positive, but also at a lower level of statistical significance (10%). Corporate IT investment has a significant positive impact on company performance. Additionally, the corporate culture has a positive moderating effect on this relationship, at a statistically significant level of 5%. The above research demonstrates that the data presented in this paper are resilient and reliable.

6. Conclusions and Limitations

In recent years, there has been an increased focus on the relationship between technology and culture, reflecting the growing connection between technological progress and human society. An advanced technological civilization lacking a spiritual culture can potentially lead to disastrous outcomes. Culture exerts a pervasive impact on technology, providing it with guidance and a clear objective. Similarly, technology plays a crucial role in shaping culture, infusing its essence, forming the foundation of human culture, and providing significant support for human advancement and expression. Therefore, culture and technology have a reciprocal and symbiotic relationship. This study focuses on examining the impact of corporate culture building on corporate technology development by analyzing the IT investment of Chinese manufacturing businesses. Our regression analysis employing a fixed-effects model and using panel data from A-share listed manufacturing companies spanning from 2013 to 2022 demonstrates that Chinese firms' investment in IT has a positive influence on their performance. We also found that the strength of corporate culture can amplify the positive impact of IT investment on firm performance. Furthermore, this study investigates the influ-

ence of various dimensions of corporate culture on the performance of corporate IT investments. The findings suggest that different dimensions of corporate culture have varying effects on corporate IT investment performance. Notably, a strong corporate culture of integrity has a significant positive impact on corporate IT investment performance. To expand on these findings: First, the moderating effect of corporate culture on IT investment decisions illustrates the underlying process by which cultural capital facilitates technology investment. This "culture-technology" interaction model offers a novel framework for understanding strategic adaptation challenges in capital-intensive domains like R&D and digital transformation. Second, empirical evidence of an honest corporate culture's positive impact on IT performance not only validates the modernization of Eastern management's "integrity-centered" philosophy but also provides an alternative explanatory framework for global technology governance rooted in cultural diversity.

In terms of policy design, this research lays the foundation for establishing a "culture-technology" synergistic development framework. Governments could consider integrating corporate culture development into technology enterprise evaluation criteria, such as designing a dual-dimensional certification system that combines technological innovation and cultural maturity, and offering R&D subsidies or tax incentives to enterprises achieving breakthroughs in both areas. Industry associations could lead the development of digital maturity assessment frameworks incorporating metrics like core value alignment and cultural endogenous factors. However, it is essential to acknowledge research limitations: the sample's focus on Chinese A-share manufacturing listed companies may introduce selection bias, as cultural dynamics in non-listed SMEs and service-sector enterprises could differ significantly. This study operationalizes cultural dimensions using simple binary or summated variables derived from publicly available data. While this approach offers practical feasibility and enhances comparability, it fails to fully capture the depth and complexity of cultural constructs—particularly multi-dimensional aspects such as Strength and Trust. The limited construct validity of these measures may explain the non-significant results regarding their relationship with performance. Additionally, the unique cultural context of "From Family to Nation to the World" in China versus Western contractual norms may lead to distinct pathways for honesty culture's impact on performance. Future research must therefore refine localized measurement of cultural variables and conduct cross-cultural comparative analyses.

In the context of corporate culture investigation, this study presents the empirically supported FSV three-level culture hypothesis. However, there are varying academic perspectives on how to define cultural dimensions and establish criteria for quantification. This study did not employ a tangible questionnaire to thoroughly investigate the three elements of corporate culture, which posed difficulties in quantifying these characteristics. In order to more precisely measure these moderating variables, future research could develop questionnaires that specifically target the fundamental principles, internal training initiatives, and promotional efforts related to the cultural values of the listed companies. Future research should examine the relationship between IT investment and performance in multinational or other types of organizations, as well as the influence of corporate culture intensity and dimensionality as moderating factors. To obtain a more thorough understanding of the intricate relationships between IT investment, corporate culture, and business performance, future studies could do so by broadening the sample range and analyzing the practical experiences of various types of firms. Building on this groundwork, subsequent studies could then achieve greater progress, aiming to offer more comprehensive and precise practical recommendations and theoretical insights.

Availability of Data and Materials

The datasets used for this study are not publicly available as they are collected at high cost but are available from the corresponding author on reasonable request.

Author Contributions

PJ and LY designed the research study. HJ and CZ performed the research. HJ analyzed the data. HS and LZ written the initial draft of manuscript. PJ and LY modified the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

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Conflict of Interest

The authors declare no conflict of interest.

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