

## Article

# Research on the Relationship between Digital Transformation and Performance of SMEs

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**Abstract:** Objective: Through an empirical analysis of the performance of SMEs undergoing digital transformation, this study attempts to identify the influencing factors that determine their sustainable development to provide reference for academic researchers and industrial decision makers. Method: This study first uses an interview method to investigate the impact of SMEs' three main resources on digital transformation: digital technology, employee digital skills, and digital transformation strategy. Second, we assess the impact of digital transformation on financial performance. Using the structural equation model, 335 valid questionnaires were recovered through the questionnaire method, and the key factors were identified using SPSS and SPSSAU tools. Results: In the Chinese context, digital transformation affects SME performance, and the three resources mentioned above are positively correlated with SMEs' digital transformation. Digital transformation is positively correlated with performance, and it is the mediator of the impact of digital transformation strategies on performance. Conclusion: For SMEs, focusing on investing in digital technologies, employee digital skills, and digital transformation strategies are three key factors that are beneficial for digital transformation, thus helping to improve performance and maintain their sustainable development.



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**Keywords:** resource-based view; digital transformation; small- and medium-sized enterprises; performance; sustainable development

## 1. Introduction

The fourth industrial revolution, marked mainly by digital transformation, is booming. The essence of digital transformation is to use the digital characteristics of copying, linking, simulation, and feedback to quantify all aspects of the business. With clear quantitative indicators and data, targeted analysis and optimization can be carried out, and management can be refined to every detail, thereby improving the overall operating level of the enterprise. Small- and medium-sized enterprises (SMEs) should adapt to the new round of scientific and technological revolution and the trend of industrial transformation; grasp the dividends of digital technology; and improve their abilities of rapid perception, agile response, and intelligent decision making in the digital age to enhance their ability to deal with risks and sustainable development. Judging from the successful cases of many traditional industries, it is normal for enterprises to increase the efficiency of each link by 30–50% after completing the digital transformation, and the entire enterprise can improve its operating efficiency by 8–10 times.

The coronavirus disease 2019 (COVID-19) pandemic has further accelerated the process of digital transformation of SMEs [1], as well as the development strategy of China's new infrastructure; thus, there are more SMEs as research objects. Therefore, in this study, we focus on digital transformation. However, digital transformation is a long-term complex system engineering that consists of four consecutive stages of digital transformation to support the enterprise's digital system development [2]. Moreover, digital transformation is

“the most common and complex stage” [3]. Most SMEs, with their limited resources, have difficulties in dealing with this complex situation. We exploratively survey SMEs that have implemented digital transformation, trying to find the key factors (resources) that affect digital transformation to solve the difficulties and challenges of the digital transformation of SMEs.

We believe that the purpose of digital transformation is innovation. Through digital transformation, SMEs have found a new paradigm for development [4]. Compared with large enterprises, SMEs have the advantage of flexibility and can accept innovation. Therefore, as a method of organizational change, it is relatively easy for SMEs to carry out digital transformation. Some scholars have found from the perspective of VUCA that during the COVID-19 pandemic and blockade period, digitally immature organizations are vulnerable, while organizations with a high degree of digitalization are usually more flexible [5].

Although numerous academic studies on digital transformation have appeared recently, it should be pointed out that these studies are mostly aimed at digital native enterprises, platform enterprises, and large enterprises. Owing to limited resources, SMEs have slowed the digital transformation process. Therefore, the empirical research on the digital transformation of SMEs is insufficient. Relevant empirical research focuses on the success factors of the digital transformation of SMEs [6], but there is a lack of empirical research on the relationship between different stages of digital transformation and performance [7]. Therefore, our research goal is to investigate the current stage of digital transformation of small- and medium-sized enterprises, find out the key influencing factors of digital transformation from the perspective of the enterprise, and verify the impact mechanism of digital transformation.

The research object of this paper is small- and medium-sized enterprises in China. Based on previous research, a resource-based digital transformation performance framework is adopted. Three influencing factors of digital transformation of small- and medium-sized enterprises are identified, and the influence mechanism is empirically analyzed using the structural equation model. The study found that the success of digital transformation requires a combination of three factors: digital technology, digital skills, and digital transformation strategy. Digital technology is the foundation of digital transformation, digital skills are the key to digital transformation, and digital transformation strategy is the primary task of digital transformation. This study enriches and expands the research in the field of digital transformation, helps to deepen the knowledge and understanding of digital transformation of SMEs, and promotes the success of digital transformation by investing in key resources. In addition, it provides a path, method, and reference for the management practice of SMEs.

## 2. Literature Review

### 2.1. Digital Transformation

Recent research helps us to understand the process of digital transformation of enterprises, and the perspective of the existing literature helps to clarify the concept and definition of digital transformation. After reviewing 23 typical definitions, scholar Vial believes that digital transformation refers to the process of triggering organizations to make strategic responses through digital technologies such as information, computing, and communication, changing their structure, boundaries and even value generation paths, and then realizing the process of enterprise entity evolution [8]. Some scholars also believe that digital transformation is a high-level transformation that is based on digitization and digitalization, further touches the company's core business, and aims to create a new business model. Digital transformation entails the development of digital technology and support capabilities to create a dynamic digital business model [9]. Other scholars believe that enterprise digital transformation refers to the process of triggering major changes in enterprise organizational characteristics and reconstructing the organizational structure, behavior, and operating system through the combined application of information technology (IT), computing, communication, and connection technologies [10].

Based on previous research, we believe that digital transformation is anchored in digital technologies, including artificial intelligence, big data, cloud computing, and blockchain, to empower enterprises and vigorously develop new technologies, new products, new models, and new formats, such that enterprises can obtain a sustainable development model with diversified efficiency. This concept embodies the four aspects that enterprises need to grasp systematically to carry out digital transformation. First, digital transformation is a systemic change triggered by digital technology. Second, the main task of digital transformation is the reconstruction and innovation of value systems. Third, the core path of digital transformation is the ability to form new kinetic energy, continuously create new value, and achieve sustainable development. Ultimately, the key elements of digital transformation are technology, people (skills), and strategies that are appropriate to the stage of the business. Therefore, in the digital transformation process, enterprises need a clear strategy (path), correct method (technology), suitable talent, and so on to form an effective digital transformation system, systematically promote transformation and change, and accelerate the progress of the innovation stage of continuous development.

## *2.2. Key Factors for the Digital Transformation of SMEs*

The digital transformation of SMEs is a path of differentiation that is inherently constrained by industry, scale, stage, technology, and resources. Meanwhile, an enterprise's digital transformation is a complex systematic project. It entails not only the use of online payment and sales tools, but also transformation model selection, business model innovation, organizational structure optimization, and asset management changes. Systematic digital empowerment is carried out through R&D, production, sales, warehousing, logistics, marketing, and other links, and finally, the industrial closed loop is realized, involving all aspects of intelligent production, digital logistics, data risk, and other issues.

Some scholars have found that SMEs face many difficulties in digital transformation [11]. First, SMEs lack adequate knowledge about themselves. Digital transformation is not only a technological update, but also an all-round change in business philosophy, strategy, organization, and operation, which requires overall planning. Most SMEs have a strong desire for digital transformation, but they generally lack clear strategic goals and practical paths, and they face challenges in technology, business capacity building, and talent training. Second, the application of digital technology in my country's SMEs is not high at present, and more than 70% of SMEs have not yet undergone large-scale digital transformation. The application level of digital technology is not high, which is reflected not only in the application depth of digital technology, but also in the application breadth of digital technology. Finally, digital transformation requires the support of financial, material, human, and other resources. Insufficient strength or following the current trend of transformation will not contribute to the sustainable development of SMEs.

In recent years, several studies have been conducted on the factors that influence the success of digital transformation. Some studies report that the six dimensions of an enterprise's strategic vision, consistency of vision and digital transformation investment, suitability of innovation culture, possession of sufficient intellectual property assets and know-how, strength of digital capabilities, and use of digital technology can be improved. This enables a business to achieve a successful competitive position through digital transformation [12]. Some studies have also found that there are four factors for successful digital transformation: customer centricity, governance, innovation, and resource acquisition [13]. "In addition to technology adoption, important factors for successful digital transformation are the organization's ability to change and its operational excellence in integrating external digital services with internal IT support" [14]. Support from the top management team is also key to digital transformation [15]. Digital transformation can be successful for SMEs through planning, aligning organizational interests, consistent and regular communication, providing resources and tools, mobilizing people, and establishing accountability and timelines for deliverables [16]. A unified strategic objective is also critical for successful and rapid digital transformation [17]. There are 11 determinants of success that are critical

to SMEs' digital transformation efforts, with external support for digital being the first step and operational technology readiness being the most challenging determinant of success [18]. Cooperation is reflected in various stages of SME digital transformation projects, such as business needs adjustment, project portfolio creation, technology solution selection, and later stages [19]. Studies have also found that three major resources—IT, human resources, and business strategy—have a positive impact on the digital transformation of SMEs; however, these factors are barriers to the digital transformation of these enterprises. Furthermore, digital transformation has a positive impact on the business outcomes of SMEs [20]. From a holistic perspective, six key factors for the digital transformation of SMEs are identified from the three dimensions of technology, organization, and environment: government support, partnership, top management, digital strategy, IT infrastructure, and IT management capabilities [6]. Employee skills are the moderating factor. Digital transformation is a long-term and arduous task, facing challenges in technology, business capacity building, talent training, and so on, but it is not unattainable. Only by focusing on key elements and by adding external assistance according to their own strength can SMEs iteratively innovate (Table 1).

**Table 1.** Summary of the literature reviewed.

Reference	Method	Context	Key Factors
[12]	Literature review	Media company, lodging company, retail company, pharmaceutical company	Strategic vision, culture of innovation, know-how and intellectual property, digital capability, strategic alignment, technology assets
[13]	Qualitative research	Large organization	Customer centricity, governance, innovation, and resource attainment.
[14]	Multiple case studies	Three companies from different industries that are in different stages of digital transformation	Technology adoption, the ability of an organization to change and operational excellence in the integration of external digital services with internal IT support
[15]	In-depth interview	Large German firms	Top managers: understanding digitalization, setting the formal context for digitalization, and leading change
[16]	Exploratory factor analysis	Education	Planning, aligned organizational interests, consistent and regular communication, provision of resources and tools, engaging faculty and creating accountability and timelines with deliverables
[17]	Case study	Public health system	A unified purpose is essential to successful, rapid digital transformation
[18]	Exploratory factor analysis	Small and medium enterprises	Eleven success determinants, namely: business partner digital maturity, cybersecurity maturity, change management competency, digitalization readiness preassessment, external support for digitalization, information and digital technology expertise, information and digital technology readiness, management competency for digital transformation, manufacturing digitalization strategic road mapping, operations technology readiness and resource availability
[19]	Longitudinal case studies	Two manufacturing SMEs	The collaboration manifests itself at various stages of the transformation projects, such as the business needs alignment, project portfolio creation, technology solution selection, and post-mortem phase
[20]	Qualitative research	Small and medium enterprises (SMEs)	Three main resources (IT, human resources, and business strategy) have a positive impact on the digital transformation of SMEs
[7]	Qualitative research	Small and medium enterprises (SMEs)	Technological and environmental factors have a positive impact on organizational capabilities, and then promote the success of DT of SMEs. Organizational capabilities play an intermediary role in the influence of technological and environmental factors on DT. In addition, employee skills positively moderate the relationship between organizational capabilities and the success of DT

### 3. Materials and Methods

#### 3.1. Resource-Based View

The American economist Penrose was one of the earliest scholars to advocate for the concept of enterprise resources. Penrose defines resources as “the physical objects purchased, leased, or manufactured by an enterprise for its own use and the labor force employed on certain terms.” She also emphasizes that the heterogeneity (rather than homogeneity) of productive or potentially productive services produced by firms from their own resources gives each firm its unique characteristics [21]. The publication of Wernerfelt’s “Resource-based Theory of Enterprises” in 1984 signified the birth of resource-based theory [22]. Barney’s research suggests that there may be a kind of heterogeneity or difference between companies and that some companies maintain a competitive advantage [23]. Therefore, resource-based theory emphasizes strategic choices and believes that the strategic task of corporate management is to find, develop, and allocate this part of the distinctive key resources in order to maximize business returns. According to Peteraf’s point of view, the resources controlled by an enterprise must satisfy four conditions (i.e., valuable, rare, inimitable, non-substitutable) to generate sustainable competitive advantage for the enterprise [24]. Adopting the resource-based view and the inheritance and development of this theory, Teece et al. defined dynamic capability as the ability of a company to integrate, construct, and reconfigure internal and external capabilities to cope with a rapidly changing environment [25]; from here, dynamic capability theory gradually formed and then developed rapidly.

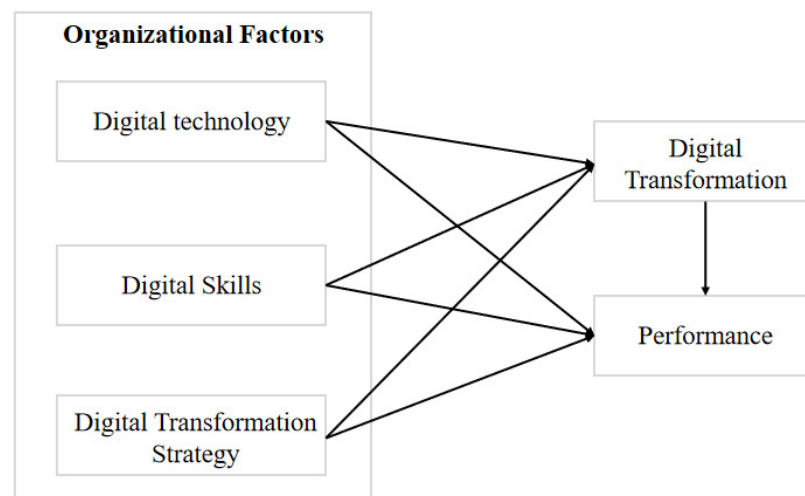
At different stages of digital transformation, enterprises have different requirements for organizational structure, organizational culture, growth strategy, and digital and other related resources or capabilities, and their coordination and adaptation will help to promote enterprise digital transformation [7]. However, some studies have found that SMEs have difficulty starting their digital journey because of a lack of resources and expertise. As an enabling mechanism, dynamic capabilities can facilitate digital transformation [26]. Additionally, perception ability, learning ability, integration ability, digital leaders, and key resources have an important impact on the digital transformation of enterprises, among which perception ability and learning ability are also important “triggers” for enterprise digital transformation [27]. While mediating the relationship between digital transformation and enterprise performance, dynamic capabilities also mediate the joint effect of digital transformation and individual forgetting on innovation performance, and the joint effect of digital transformation and entrepreneurial orientation on innovation performance. The three interactive effects of entrepreneurial orientation also play a mediating role in the relationship between performance [28].

By embracing resource-based theory (including dynamic capability theory), we reviewed the relevant literature to better understand our assumptions about digital transformation and performance and the three key resources of SMEs—digital technology, employee digital skills, and digital transformation strategy.

#### 3.2. Proposed Conceptual Model and Hypothesis Formulation

Resource-based theory posits that an enterprise is a collection of various resources. Owing to various reasons, the resources owned by enterprises are different and heterogeneous, and this heterogeneity determines the differences in the competitiveness of enterprises. However, resources can only be used as a basis for competitive advantage if they conform to the VRIN framework. Specifically, VRIN refers to valuable resources (which are the basis for companies to conceive and execute corporate strategies, as well as improve efficiency and effectiveness); rare (that is, scarce) resources (because even if the resource is valuable, once owned by most companies, it cannot bring competitive advantage or sustainable competitive advantage); imperfectly imitable resources (that is, resources that cannot be imitated, which generally need to have the following three characteristics simultaneously: unique historical conditions, vague causes, and social complexity); and non-substitutable resources (that is, irreplaceable resources, which do not have a substitute that is both replicable and

not scarce). This is because enterprises have different tangible and intangible resources, which can be transformed into unique capabilities, and resources are immobile and difficult to replicate among enterprises; these unique resources and capabilities are the source of lasting competitive advantages for enterprises [22]. Compared with the external conditions of the enterprise, the internal conditions of the enterprise play a decisive role in obtaining competitive advantage in the market. Therefore, our research focused on the organization itself and identified three key resources (elements) that SMEs in digital transformation need: digital technology, digital skills, and digital transformation strategy. We use structural equation modeling to verify the impact of digital technology ( $x_1$ ), digital skills ( $x_2$ ), and digital transformation strategy ( $x_3$ ) on digital transformation ( $Y_1$ ) and performance ( $Y_2$ ). See Figure 1.



**Figure 1.** Conceptual model and research hypothesis.

The model parameters are as follows:

$$y_i = a + B y_i + \Gamma x_i + \zeta_i \quad \text{var}(\zeta_i) = \Psi$$

Given  $p$ -endogenous and  $q$ -exogenous variables:

$y_i$  is a  $p \times 1$  vector of observed endogenous variables

$x_i$  is a  $q \times 1$  vector of observed exogenous variables

$a$  is a  $p \times 1$  vector of regression intercepts

$B$  is a  $p \times p$  matrix of regression slopes

$\Gamma$  is a  $p \times q$  matrix of regression slopes

$\zeta$  is a  $p \times 1$  vector of disturbances (i.e., residuals)

$\Psi$  is a  $p \times p$  covariance matrix of disturbances

### 3.2.1. Digital Technology

The basic idea behind the implementation of digital transformation by SMEs is to change work and business processes based on digital-technology-driven improvements; in this way, business operations can be made more efficient. Artificial intelligence has been proposed for decades, but it has only experienced explosive growth in the past two years. The reason lies in the increasing maturity of technologies such as cloud computing, the Internet of things (IoT), and big data. Cloud computing provides an open platform for artificial intelligence, the IoT ensures real-time data sharing, and big data provides unlimited resources for deep learning. In addition, the development of blockchain technology in 2018 can make up for the shortcomings of artificial intelligence in data security and data factors, and provide a reliable guarantee for the application of artificial intelligence in different scenarios. Some studies have found that digital transformation can be achieved through

artificial intelligence [29]. The IoT plays an important role in digital transformation [30,31]. Blockchain technology affects digital transformation [32,33]. Notably, 5G networks also play a role in digital transformation [34]. The use of social media in management affects the overall performance of enterprises [35]. In summary, driven by the digital technology represented by cloud computing, big data, artificial intelligence, and blockchain, the value chain is breaking and reshaping, new ecosystems are emerging, and industry boundaries are becoming increasingly blurred. An increasing number of traditional enterprises are trying to calmly restructure their business models to cope with industry changes and expand their businesses across traditional industry boundaries.

**Hypothesis 1 (H1).** *Digital technology is positively correlated with the digital transformation of SMEs.*

### 3.2.2. Digital Skills

In the digital transformation process, an increasing number of companies are beginning to realize the importance of talent team building, because the implementation of digital strategies requires the support of digital talents with business capabilities, overall views, as well as digital concepts and skills. Kane believes that people are the real key to digital transformation [36]. Therefore, the self-management team is key to starting the digital transformation of enterprise management [37]. The rapid development of employees' individual cognitive and process capabilities promotes the digital transformation process of enterprises [38]. Bessonova et al. discussed the digital literacy of employees as readiness for digital transformation [39]. Studies have found that employees' digital mindset can affect their participation in or exit from a company's digital transformation program [40]. Personal digital ability is related to SME growth and innovation performance [41]. However, some companies have not yet started digital transformation, which is also due to the lack of human capital and the digital skills of employees [42]. Therefore, organizations must develop virtual human resource development and use learning resources to prepare for the future [43]. The empowerment of the organization is effective only when the right people are selected, and everything we do in the future will be multiplied with half the effort. Therefore, regarding digital transformation, the biggest challenge of the organization is not the specific business, but the people.

**Hypothesis 2 (H2).** *Employee digital skills are positively correlated with SME digital transformation.*

### 3.2.3. Digital Transformation Strategy

A digital transformation strategy is a prerequisite for successful digital transformation. By developing an effective, clear, and sound digital transformation strategy, one can ensure that one's digital transformation is as seamless as possible. A digital transformation strategy is like a personalized map that can bring great value in business transformation. The formulation and implementation of a digital transformation strategy has become a key concern for organizations prior to digital transformation across many traditional industries [44]. Four common types of digital transformation strategies are formed via two dimensions: the use of digital technologies and the preparation of business models for digital operations [45]. Studies have found that SMEs are strengthening their digital transformation strategies through innovative technologies and new values that restructure business models and processes [46]. Presently, many enterprises have completed the strategy formulation stage of digital transformation and are in the strategy implementation stage [47]. A new strategic implementation framework can be adopted in digital transformation, which is divided into three phases: planning, implementation, and review [48]. In summary, digital transformation is the best strategy for an enterprise, and it must be reflected in the whole process execution of business, operation, and performance appraisal. It is no longer sufficient to

stay at the technical level; it is necessary to digitalize all aspects of decision making, work, and cooperation, and provide the best experience for customers.

**Hypothesis 3 (H3).** *Digital transformation strategies are positively correlated with the digital transformation of SMEs.*

#### 3.2.4. Digital Transformation and Performance

Existing research finds that digital transformation has an impact on corporate financial performance [49]. Enterprise digital transformation has a positive effect on enterprise performance [50]. The positive impact of digital transformation on enterprise performance is more evident in large enterprises, state-owned enterprises, mature enterprises, and non-manufacturing (service) enterprises. The positive impact of digital transformation on enterprise performance and supply chain integration is not significant in small- and medium-sized enterprises; supply chain integration cannot play an intermediary role in the relationship between the digital transformation of manufacturing enterprises and enterprise performance [51]. Three major resources (IT, human resources, and business strategy) have a positive impact on the digital transformation of SMEs, and digital transformation has a positive impact on the business results of SMEs [20]. Digital transformation has a positive effect on the dynamic capabilities of enterprises; the higher the intensity of individual forgetting and the stronger the entrepreneurial orientation, the stronger the positive impact of digital transformation on the dynamic capabilities and innovation performance of enterprises [28]. Some of the benefits of digital transformation for enterprises are the transformation and optimization of traditional stock businesses through digital technology; improving the level of large-scale production and trading of traditional products; and realizing value benefits, such as efficiency improvement, cost reduction, and quality improvement.

**Hypothesis 4 (H4).** *Digital transformation is positively correlated with financial performance.*

#### 3.2.5. Complementarity of Resources

Digital technology, employee digital skills, and digital transformation strategies are the three core elements for SMEs to carry out digital transformation from point to face, local to global, and in stages. All three are indispensable in the ongoing digital transformation process. Previous research has found that, in addition to technology adoption, important factors for successful digital transformation are the organization's ability to change and its operational excellence in integrating external digital services with internal IT support [14]. Another study reports that digital transformation at the enterprise level requires attention to the alignment of strategy, vision, and digital transformation investment; the suitability of innovation culture; intellectual property and know-how; the strength of digital capabilities; and the use of digital technology [12]. Digital transformation strategies have a positive impact on short- and long-term financial performance [52]. There is a significant correlation between big data, IoT, blockchain, and performance [53]. Other studies suggest that the variables that have the greatest impact on SME performance are management, technology, and marketing and innovation capabilities [54]. In short, the digital transformation of an enterprise is a dynamic process. Continuous iteration, the development of digital products and services based on data, and the realization of intelligent operations through digital technology are essential. When digital technology penetrates into every corner of an enterprise, continuous and rapid innovation capabilities will become the core driving force for enterprises to maintain competitiveness, thereby helping enterprises to make steady progress on the road of digital transformation. Enterprises that achieve intelligent operations can make real-time and correct decisions; fully integrate talent, data, and intelligent technology; drive process transformation and incorporate agility and rapid response capa-



bilities; continuously improve user experience; and achieve breakthrough business results. Sustainable digital transformation can only be achieved through sustainable technological innovation and intelligent operations.

**Hypothesis 5 (H5).** *The relationship between (a) digital technology, (b) employee digital skills, and (c) digital transformation strategy and financial performance is mediated through digital transformation.*

## 4. Results

### 4.1. Measurement and Data Collection

We tested five hypotheses among SMEs (1–299 employees) from various provinces within China, and the questionnaire was designed after on-site interviews with SMEs. After the review of relevant experts and the pre-test, we comprehensively considered the analysis results of 30 questionnaires and China's national conditions; adjusted the evaluation of questions, wording, and consistency; and improved the reliability and effectiveness of the questionnaire. The survey targets are executives of SMEs, who are familiar with the specific operation of the company and can ensure that the data truly reflect the actual application of digital technology in SMEs. The quantitative data were collected through an online survey platform that collected 335 complete and correctly filled questionnaires by the end of 2021. See Appendix A.

**Independent variable:** The design of the independent variables was conducted in advance through corporate interviews. Employee digital skills (DS) uses a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Digital transformation strategy is evaluated using a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Digital technology (DT) uses a seven-point Likert scale ranging from 1 ("very low") to 7 ("very high").

**Dependent variable:** Except for listed companies, Chinese SMEs are not obliged to publish financial data. The Entrepreneur Orientation Scale adopted by Lumpkin and Dess [55] was used. Financial performance variables (FP) were measured using a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). The scale measures how SME executives feel about the financial performance of their companies after digital transformation.

**Mediating variable:** The mediating variable, digital transformation (DX), is an assessment of an enterprise's digital transformation maturity, using the seven-point Likert scale adopted by Bley et al. [56], ranging from 1 ("very low") to 7 ("very high").

**Control variable:** Financial performance may be affected by other factors, and control variables can prevent test failures for the dependent variables [57,58]. The control variables are the number of employees, gender of executives, and readiness for digital transformation. The readiness for digital transformation is measured by Xiaodong Ma [59].

### 4.2. Measurement Model

The SEMs approach used in this study is a method for establishing, estimating, and testing a causal relationship model. The model contains both observable explicit variables and latent variables that cannot be directly observed. Table 2 shows the descriptive statistics of the data sample: medium-sized enterprises account for 77% of the total. The information and communication technology industry, media, and finance accounted for 34%. Levels 2 and 3 of digital transformation are the most common, accounting for 33%.

SPSS 21 software is used to test reliability and validity, and the results are shown in Table 3, evaluated using mean, SD, Cronbach's alpha, CR, and AVE. All  $\alpha$  and CR values exceeded the threshold of 0.70, and all AVE values were above the recommended threshold of 0.50; thus, all indicators showed good reliability. We used factor loadings and square root of AVE to measure convergent and discriminant validity, respectively. The results showed that all factor loadings were greater than 0.7 at the significance level of  $p < 0.01$ ,

indicating good convergent validity. The correlation coefficient of each factor with other factors confirmed the discriminant validity.

**Table 2.** Sample demographic information.

Measure	Items	Size	Percentage
Firm scale (people)	Micro enterprises (<10)	1	0.30%
	Small enterprise (10–99)	77	22.99%
	Medium enterprise (100–299)	257	76.72%
Industry	Information and communication technology industry, media, and finance	114	34.03%
	Consumer industry (entertainment and leisure, retail trade, etc.)	68	20.30%
	Service industries (utilities, healthcare, education, etc.)	63	18.81%
	Capital-intensive industries (high-end manufacturing, oil and gas, basic product manufacturing, chemical and pharmaceutical, etc.)	65	19.40%
	Localization industries (agriculture, personal and local services, hospitality, construction, etc.)	25	7.46%
Levels of digital transformation	Level 0: Data not applied (no data analysis tools, lack of data awareness at decision-making level, decision making relying on leadership “whims”, etc.)	5	1.49%
	Level 1: Scattered use of data (simple data, used for statistical reports, infrequent use, unable to handle large-scale data sets, etc.)	45	13.43%
	Level 2: Technology center assists decision making (with certain data thinking, used by major technical departments, unable to respond in real time, etc.)	109	32.54%
	Level 3: Systematic operation of the technology center (complex data applications, technology struggling to meet simple needs, low ability to capture business opportunities, etc.)	109	32.54%
	Level 4: Business-centered data-based operations (data analysis, freeing up technical time and manpower, business-oriented data assets, strong ability to capture business opportunities, etc.)	62	18.51%
	Level 5: Data competitiveness formation (innovative business models; data ecology formation; deep accumulation of data, models, and application assets, with data operation and practical experience; etc.)	5	1.49%

**Table 3.** Descriptive statistics and correlations.

Items	Mean	SD	Cronbach’s Alpha	CR	AVE	DX	DS	DTS	DT	FP
DX	4.5711	0.98601	0.751	0.876	0.772	1.00				
DS	4.7373	0.98504	0.732	0.849	0.751	0.625 **	1.00			
DTS	5.4145	0.78292	0.792	0.919	0.854	0.182 **	0.247 **	1.00		
DT	4.8280	0.91577	0.718	0.831	0.754	0.631 **	0.633 **	0.302 **	1.00	
FP	5.1602	0.86940	0.767	0.882	0.834	0.270 **	0.345 **	0.683 **	0.393 **	1.00

Note(s): \*\*  $p < 0.01$ ,  $n = 335$ . Digital transformation (DX); employee digital skills (DS); digital transformation strategy (DTS); digital technology (DT); financial performance (FP).

#### 4.3. Regression Analysis

After factor analysis and reliability tests, we perform multiple regression analysis to test hypotheses H1–H4, and Table 4 shows the results of the multiple regression analysis.

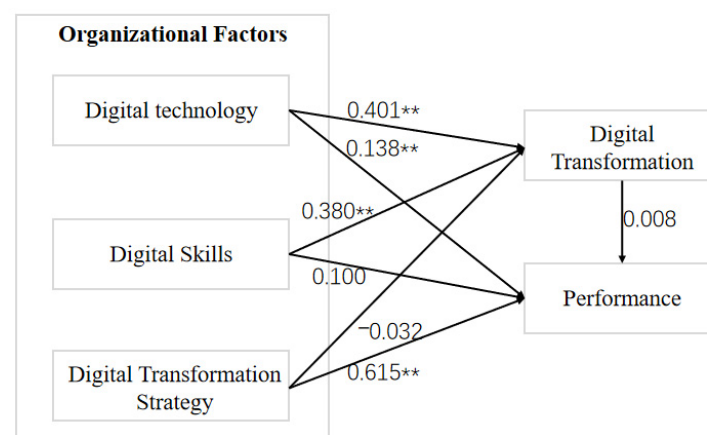
**Table 4.** Results regression analysis.

Variables	DX	DX	DX	FP
DT	0.000 **			
DS		0.000 **		
DTS			0.001 **	
DX				0.000 **
R2	0.398	0.391	0.033	0.073

Note(s): \*\*  $p < 0.01$ , Digital transformation (DX); employee digital skills (DS); digital transformation strategy (DTS); digital technology (DT); financial performance (FP).

#### 4.4. Structural Model

To ensure the consistency of the estimates, we use the “path analysis” in the web version of SPSSAU to estimate the coefficients and significance of each path. Figure 2 shows the path coefficients in the test results obtained using the structural equation model. It can be seen from Figure 2 that when digital transformation has an impact on financial performance, this path does not appear significant ( $z = 0.158$ ,  $p = 0.875 > 0.05$ ), thus indicating that digital transformation has no impact on financial performance. When digital skills have an impact on financial performance, this path does not appear significant ( $z = 1.872$ ,  $p = 0.061 > 0.05$ ), thus indicating that employees’ digital skills have no impact on financial performance. When the digital transformation strategy has an impact on financial performance, the standardized path coefficient value is  $0.615 > 0$ , and this path shows a significant level of 0.01 ( $z = 15.292$ ,  $p = 0.000 < 0.01$ ), thus indicating that the digital transformation strategy will have an impact on financial performance (significant positive impact relationship). When digital technology has an impact on financial performance, the standardized path coefficient value is  $0.138 > 0$ , and this path shows a significant level of 0.05 ( $z = 2.523$ ,  $p = 0.012 < 0.05$ ), thus indicating that digital technology will have a significant impact on financial performance (positive influence relationship). When employees’ digital skills have an impact on digital transformation, the standardized path coefficient value is  $0.380 > 0$ , and this path shows a significant level of 0.01 ( $z = 7.466$ ,  $p = 0.000 < 0.01$ ), thus indicating that employees’ digital skills will have an impact on digital transformation (significant positive impact relationship). When the digital transformation strategy has an impact on the digital transformation, this path does not appear significant ( $z = -0.786$ ,  $p = 0.432 > 0.05$ ), thus indicating that the digital transformation strategy has no influence on the digital transformation. When digital technology has an impact on digital transformation, the standardized path coefficient value is  $0.401 > 0$ , and this path shows a significant level of 0.01 ( $z = 7.749$ ,  $p = 0.000 < 0.01$ ), which indicates that digital technology will have a significant impact on digital transformation (positive influence relationship).



**Figure 2.** Results of structure model analysis. Note(s): \*\*  $p < 0.01$ .

We use structural equation modeling to verify the impact of digital technology ( $x_1$ ), digital skills ( $x_2$ ), and digital transformation strategy ( $x_3$ ) on digital transformation ( $y_1$ ) and performance ( $y_2$ ). The results are shown in the following equation:  $y_1 = 0.401x_1 + 0.38x_2 - 0.032x_3$ ,  $y_2 = 0.008y_1 + 0.138x_1 + 0.100x_2 + 0.615x_3$ .

#### 4.5. Mediating Effect

We use the process plug-in in SPSS and the bootstrap method to test the mediation effect. That is, we measure the direct and indirect effects between the mediator variable DX and the dependent variable FP, and the effects of the three independent variables, DT, DS, DTS, and DX. Table 5 shows the results of the mediation analysis.

**Table 5.** Results of mediation analysis.

Hypothesis	Effects	Pathways	P	Coeff.	95%CI	Mediation Existence	
DT- > DX- > FP	Direct Effect	c'	0.000	0.350	0.229	0.471	Mediating effect is not significant
	Indirect Effect	a*b	0.000	0.022	-0.064	0.115	
	Total Effect	c	0.000	0.373 **	0.279	0.466	
DS- > DX- > FP	Direct Effect	c'	0.000	0.255	0.141	0.368	Mediating effect is not significant
	Indirect Effect	a*b	0.000	0.050	-0.032	0.144	
	Total Effect	c	0.000	0.304 **	0.215	0.393	
DTS- > DX- > FP	Direct Effect	c'	0.000	0.728	0.641	0.815	Partial
	Indirect Effect	a*b	0.001	0.030	0.006	0.055	
	Total Effect	c	0.000	0.759 **	0.671	0.846	

\*\*  $p < 0.01$ .

In terms of the mediation path DT > DX > FP, findings showed that no clear mediating role between digital technology and financial performance. Its structural equation model results are as follows:  $y_2 = 3.361 + 0.373x_1$ ,  $y_1 = 1.290 + 0.680x_1$ ,  $y_2 = 3.319 + 0.350x_1 + 0.033y_1$ .

For the mediation path DS > DX > FP, findings showed that no clear mediating role between digital skills and financial performance. Its structural equation model results are as follows:  $y_2 = 3.719 + 0.304x_2$ ,  $y_1 = 1.606 + 0.626x_2$ ,  $y_2 = 3.592 + 0.255x_2 + 0.079y_1$ .

Regarding the mediation path DTS > DX > FP, findings showed that digital transformation partially mediates the relationship between digital transformation strategy and financial performance. Its structural equation model results are as follows:  $y_2 = 1.053 + 0.759x_3$ ,  $y_1 = 3.327 + 0.230x_3$ ,  $y_2 = 0.611 + 0.728x_3 + 0.133y_1$ .

## 5. Discussion

This paper contributes to a better understanding of the factors influencing the digital transformation of SMEs and their relationship to performance. The empirical examination examines the relationship between three key resources of SMEs (digital technology, employee digital skills, and digital transformation strategy) and digital transformation, and the impact of these three resources and digital transformation on financial performance. These results suggest some important findings.

First, digital technology has a positive impact on the digital transformation of SMEs (Hypothesis 1/H1). This shows that digital technologies (resources including artificial intelligence, blockchain, cloud technology, big data, 5G, IoT, social media, and cyber-security technologies) contribute to the digital transformation of SMEs. This shows that digital technology is the foundation of digital transformation, and SMEs should consider the different stages they are in and choose the digital technology that suits them, in order to contribute to digital transformation, rather than blindly choosing digital technologies without analysis, or simply using digital technologies to gain various benefits from digital transformation [6].

This result is consistent with RBV's complementary view that digital technology needs to be deeply integrated with the business and management of the enterprise, combined with the enterprise's strategy and the digital skills of its people, in order to form a strong dynamic capability to realize the value of digital technology [8]. This can also explain why many SMEs have invested in digital technology, but digital transformation has not achieved much. Therefore, SMEs must understand and correctly use different digital technologies to give full play to their value in enabling digital transformation.

Second, employee digital skills have a positive impact on SMEs' digital transformation (Hypothesis 2/H2). This shows that digital transformation depends on employees with digital skills. Digital technology does not function independently, nor does it always work well. To successfully master these digital methods and technologies, SMEs will rely on a large number of employees who are familiar with and adept at digital tools [6]. For SMEs to successfully implement digital transformation, people are as important as technology, and everything from corporate vision and strategy to execution involves people. Employee digital skills are key to digital transformation.

Third, the digital transformation strategy has a relevant but not significant impact on the digital transformation of SMEs (Hypothesis 3/H3). To carry out digital transformation, we must first carry out top-level design. Previous studies have found that in order to successfully achieve digital transformation, companies must first develop a comprehensive digital transformation strategy [60]. It should be taken as an important part of the development strategy to root the data-driven concepts, methods, and mechanisms in the overall development strategy, and systematically design digital transformation around the vision, goals, business ecological blueprint, and other major strategic directions proposed by the company's overall development strategy. The digital transformation strategy of small- and medium-sized enterprises must be guided by value innovation and completely return to the essence of the business, so that it is possible to carry out digital transformation effectively, quickly, and comprehensively.

The results of intermediary analysis (h5a to h5c) show a more complex situation. The relationship between (a) digital technology, (b) employee digital skills, (c) digital transformation strategy, and financial performance is mediated through digital transformation. Regarding transformation, on the direct and indirect paths (H5c), digital transformation strategies had a positive mediating effect on financial performance, but digital technology (H5a) and employee digital skills (H5b) had no significant mediating effects on financial performance. We did multiple rounds of testing for the mediation effect, but the results were not perfect. We consider the following possibilities. One is that the digital transformation of SMEs has just started, and digital transformation is a long-term and complex system engineering [2], so the effect is not obvious, and the financial performance is not ideal. Second, at the moment of the epidemic, the cash flow of SMEs is very tight, and the price of digital technology is currently relatively expensive, so it is difficult for SMEs to bear the cost of digital transformation. Third, large enterprises, Internet companies, and information technology companies are the first to start digital transformation, which can attract talents with digital skills that are currently scarce at high salaries. SMEs are relatively less attractive, which leads to high recruitment costs and affects the process of digital transformation. Finally, it is relatively easy to formulate a digital transformation strategy. Referring to the digital transformation strategy of a benchmark enterprise and combining it with the actual situation of the enterprise can formulate a digital transformation strategy suitable for the enterprise.

## 6. Conclusions

This research helps us to understand the resources that SMEs need to deploy to succeed in their digital transformation. Digital technologies, employees digital skills, and digital transformation strategies can help to drive digital transformation, which in turn can improve the financial performance of SMEs. The digital transformation strategy is identified as the key factor affecting financial performance. In previous research, Rogers pointed out

that “digital transformation is not fundamentally a technology, but a strategy” [61]. Small- and medium-sized enterprises generally have problems such as a lack of digital transformation thinking, a weak digital foundation, and large obstacles to digital transformation [11]. Digital technology is a major obstacle to the digital transformation of SMEs. The digital skills of employees is another major obstacle to the digital transformation of SMEs [62]. The limited capital of SMEs, coupled with various obstacles, complicates the path of digital transformation. Various types of SMEs are significantly different, which increases the difficulty of digital transformation. The sooner SMEs respond to these challenges, the sooner they can capitalize on the impact to better cope with competition.

This study has several limitations. First, the data were collected in mainland China, and regional restrictions may limit the generalization of the findings. Replicating this study in other parts of the world may improve the reliability and validity of the measurement models. Second, in China, except for listed companies, ordinary SMEs are not obliged to publish financial data. Therefore, the financial performance indicators in this study are based on self-assessed data. Studies have shown that self-assessment data correlate with objective performance measures [63].

We identify some research questions that can advance the digital transformation agenda of SMEs. First, how does digital technology affect the financial performance of SMEs? How different is the degree of impact of each of the different digital technologies? Second, how do employee digital skills affect the financial performance of SMEs? How are the digital skills assessment models? Third, what are the specific indicators of the five stages of digital transformation? How does each affect the financial performance of SMEs? Fourth, are the digital transformation paths of SMEs in different industries different? Fifth, how do different application scenarios of digital transformation of SMEs affect financial performance? Finally, what dynamic capabilities will be formed by digital technologies, employees’ digital skills, and digital transformation strategies to influence the financial performance of SMEs?

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## Appendix A

**Table A1.** Research questionnaire.

Item	Observed Variables and Latent Constructs	Mean	Std. Deviation
General Information	Q1. The size of SMEs	2.76	0.432
	Q2. Gender of executives	2.46	1.330
	Q3. Executive jobs	3.58	1.032
Digital Transformation (DX)	DX1. Assess your organization’s digital transformation maturity compared to peers	4.50	1.089
	DX2. Assessment of the use of digital technology	4.61	1.228
	DX3. Assess how widely your own digital technology is used	4.60	1.330

Table A1. Cont.

Item	Observed Variables and Latent Constructs	Mean	Std. Deviation
Employee Digital Skills (DS)	DS1.We advance continuous learning in digital technologies	5.08	1.268
	DS2.A balance between general digital skills and specialized digital roles is adequate	4.69	1.322
	DS3.We can assemble teams with the right mix of skills for each digital project	4.69	1.484
	DS4.Employees are compound talents who understand both business and digitalization	4.28	1.615
	DS5.My organization provides employees with resources or opportunities to acquire the right digital skills for digital transformation	4.95	1.460
Digital Transformation Strategy (DTS)	DTS1.Your company's digital transformation strategy can increase sales	5.65	1.219
	DTS2.Your company's digital transformation strategy can improve competitiveness	5.19	1.502
	DTS3.Your company's digital transformation strategy can fundamentally change business processes	4.93	1.434
	DTS4.Your company's digital transformation strategy can improve customer experience and satisfaction	5.60	1.194
	DTS5.Your company's digital transformation strategy can improve innovation capabilities	5.64	1.247
	DTS6.Your company's digital transformation strategy can improve business decisions	5.12	1.266
	DTS7.Your company's digital transformation strategy can improve efficiency	5.78	1.178
Digital Technology (DT)	DT1.To what extent your company uses artificial intelligence	4.31	1.463
	DT2.To what extent your company uses blockchain technology	4.33	1.406
	DT3.To what extent your company uses cloud technologies (cloud computing, edge algorithms, cloud-edge collaboration)	4.64	1.482
	DT4.To what extent your company uses big data and data analytics	5.06	1.375
	DT5.To what extent your company is using mobile technology 5G	4.84	1.516
	DT6.To what extent is your company using IoT	4.70	1.429
	DT7.To what extent your company uses social media (collaboration technology)	5.39	1.322
	DT8.To what extent your company uses cybersecurity technologies	5.36	1.346
Financial Performance (FP)	FP1.Digital transformation of your business can help increase sales	5.30	1.206
	FP2.Digital transformation of your business can help return on sales	5.14	1.208
	FP3.Digital transformation of your business can help increase gross profit	5.14	1.255
	FP4.Your company's digital transformation can help increase net profit	5.14	1.283
	FP5.Digital transformation of your business can help return on equity	5.03	1.234
	FP6.Digital transformation of your business can help return on investment	5.23	1.256

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