Article

Research on Successful Factors and Influencing Mechanism of the Digital Transformation in SMEs

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Abstract: In the era of the digital economy, digital transformation (DT) has become a new approach for firms to gain competitive advantages in a context of intense and dynamic market competition. Companies in almost all industries have undergone or are currently undergoing DT. Due to limited resources and capabilities, the digitalization process of small and medium-sized enterprises (SMEs) is relatively slow, so it is critical to ascertain the key factors and paths that affect the success of DT for SMEs to optimize the allocation of resources. However, there is very little research on the DT of SMEs. In response to this literature gap, the purpose of this study is to discover the key factors of the DT in SMEs and explore their interaction mechanisms. From a holistic perspective, this study has identified six key factors from three dimensions of technology, organization, and environment, and based on the resource-based view and resource-dependence theory, constructed an action mechanism model. Structural equation modeling was used to analyze the data collected from 180 SMEs in China. The results show that 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. This study contributes to the conceptual framework and management implications in the DT field. Our study provides practitioners with profound insights into the enterprise’s DT and suggests that enterprises attach importance to the improvement of organizational capabilities, and use strategy and talents as important resources to promote the success of enterprise DT.

Keywords: digital transformation (DT); small and medium-sized enterprises (SME); success factors; employee skills

1. Introduction

With the development and application of digital technologies, such as big data, cloud computing, Internet of Things (IoT), artificial intelligence, and blockchain, China’s digital economy is showing rapid development, and the pace of digitization is accelerating, which has brought new disruptive changes to the economy and society [1]. Digital technology, digital innovation, and digitalization are fundamentally altering business processes, products, services, and relationships [2], as well as driving enterprises to fundamentally change the way they do business and the mindset of their employees, as well as forcing restructuring for survival [3]. Digital transformation (DT) has become a new approach for many firms to gain competitive advantages in a context of intense and dynamic market competition [4]. Many organizations have applied DT, with a positive impact on organization business performance [5] and productivity, leading to an increase in their superiority [6], and achieving breakthrough innovations and sustainable development [7].

However, DT has proven difficult for many organizations and is often poorly understood [8]. Although many enterprises engage in DT and invest resources in intelligent
operation and construction, the results of this work have not reached the desired level. According to the latest McKinsey research report, the current success rate for DT in enterprises is only 20%. Due to the small scale, limited resources, insufficient capabilities, and other restrictions, small and medium-sized enterprises (SMEs) face higher barriers to digital innovation than large enterprises, and it is more difficult to successfully implement DT. Moreover, DT is a complex system engineering, which is affected by the interaction of many factors to jointly promote the success of DT. While navigating the complexities associated with the DT of enterprises, many SMEs’ managers find themselves overwhelmed by the range of possible factors to consider, what the key points are, how to develop a digitization roadmap before embarking on a DT [9], and are at a loss for starting and directing the activities of DT. Therefore, it is necessary to identify and clarify the key antecedents and impact mechanisms affecting the success of DT in SMEs, which is of great significance for enterprise resource allocation, promoting the implementation and success of DT, and achieving sustainable development.

Many useful explorations have been conducted on DT in recent years, the studies on the driving or success factors, mechanisms, paths, and impacts of DT are gradually increasing. However, most studies are practical introductions and descriptive summaries of the DT phenomenon. For example, Cichosz et al. [10] use case study methods to refine the success factors for DT; Osmundsen et al. [11] summarize the driving factors and success factors for enterprise DT through a literature review. Due to the lack of large-sample empirical research, it is difficult to verify the universality of relevant factors, their internal mechanism is not clear, and the relationship between these factors is rarely discussed. Therefore, based on these research gaps, this study raised the following objectives:

1. To identify the critical factors of successful DT in SMEs from a holistic perspective.
2. To explore the interaction mechanism of technological, organizational, and environmental factors on the success of DT.
3. To examine the moderating effect of employee skills.

This study takes China’s SMEs as the research object. On the basis of previous studies, the technology–organization–environment framework is adopted to identify the critical factors for the success of DT in SMEs, and empirically analyze the mechanism of their effect on DT by using structural equation models (SEM). The study found that the success of DT is the result of the interaction of technological, organizational, environmental factors. IT resources (IT infrastructure and IT management capabilities) and environmental support (government support and partnerships) have an indirect positive impact on DT through improving organizational capabilities (digital strategy and top management). Moreover, employee skill positively moderates the relationship between organizational capabilities and DT, which partly explains the generation of differentiated value. This study enriches and expands the research in the field of DT, which helps to deepen the knowledge and understanding of SMEs to promote the success of DT by prioritizing the allocation of critical resources. Meanwhile, it provides SME managers with a methodology for DT and strategic guidance for the management practice of enterprises.

2. Literature Review

2.1. Enterprise Digital Transformation

Although DT has received significant attention in both scholarship and business practice, there is still no consensus definition [11,12]. Some scholars view it as a strategy [8], a process [12], or a business model [13]. Typically, they emphasize “the use of new digital technologies […] to enable major business improvements” [7]. With the development of theory and practice, scholars have come to realize that the DT of enterprises requires not only the use of technology, but also reshaping of the company’s vision, strategy, organizational structure, process, capabilities, and culture to adapt to the ever-changing digital business environment [14], the purpose of DT is to create value, which includes but is not limited to operational efficiency, customer experience improvement, business model enhancement, strategic differentiation, competitive advantage, stakeholder relationship
improvement, cost savings, and so on [12]. However, taking into account the current status and characteristics of DT of SMEs in China, as well as the transformational commonalities of different industries, this study defines DT as strategic interventions that enhance the digital capability of an organizational to improve its business processes, products, services, and operations management.

For SMEs, DT focused on the business dimension or on basic business processes, products, and business models [15]. However, beyond the conditions that belong to large companies, SMEs face three additional constraints: scarcity of resources, lack of specialist expertise, and limited market influence. Therefore, the prerequisites for DT of SMEs are different than those for larger organizations. A previous study [16] explains that SME actors can carry out DT through the availability of digital platforms, digital investment, social capital development, building business teams, and improving the ability of all organizational members. It is also argued by scholars [17] that DT requires more than technical capabilities but management capabilities as well, such as work process design, business strategy training, and human resources investment in digital literacy capability. Moreover, the DT process requires innovative culture, pioneering top management, effective government support, and so on. In short, certain conditions or resources are necessary for SMEs to realize DT, and it is of great practical importance to analyze the key factors that determine the realization of DT of SMEs.

2.2. Success Factors of Digital Transformation

The implementation of DT is a complex process, accompanied by many internal and external factors, and the existence of these factors is likely to lead to the success or failure of DT. Therefore, identifying success factors (that is, factors that would tend to increase the likelihood of success) and related leadership practices, as well as understanding their nature and root causes, are important prerequisites for achieving DT.

In recent years, various scholars have described a range of underlying factors that influence the overall success of DT [18]. With the development of technology, scholars have become more and more deeply aware of the changes that IT brings to society and life, and information and communication technology has become an important force for enterprises to change their business models and operational strategies [19], and it is also one of the most important drivers for companies seeking to implement DT [20]. In addition, organizational structure [21] and culture [14] have also proven to be important factors of DT. Enterprise innovation, customer centricity, business model, governance, and technology-related aspects are also considered cornerstones of achieving DT [22]. Recent research shows that organizations must align changes with their strategy to accomplish DT, and a digital business strategy can support organizational transformation and achieve the desired goals of DT [23]. Moreover, the DT process requires pioneering top management, effective government support, collaboration, innovation, and so on [18].

Table 1 lists some studies of the factors of successful organizational DT. While most studies focus on descriptive analysis and normative discussion of DT practice, the total number of large-sample empirical studies on the underlying success factors of DT is limited, and those that have been conducted do not uniformly identify the same factors. On the other hand, the research that has been conducted mainly focuses on large enterprises or manufacturing, ignoring the special situation of SMEs. Relative to the important position of SMEs in the social economy and the relative lag in the process of DT, we believe that taking SMEs as the research objects and exploring the critical factors and influencing mechanisms of DT represent the distinctive theoretical value and practical significance of this research.
Table 1. Summary of the literature reviewed.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Method</th>
<th>Context</th>
<th>Success Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>[24]</td>
<td>Literature review</td>
<td>General organization</td>
<td>Top management support, Digital readiness (technical capabilities, human resources, and knowledge), Strategically relevant projects</td>
</tr>
<tr>
<td>[25]</td>
<td>Case study</td>
<td>General organization</td>
<td>Digital strategy, Operational backbone, Digital services platform</td>
</tr>
<tr>
<td>[26]</td>
<td>Qualitative research</td>
<td>Manufacturing</td>
<td>Organizational factors (pilot projects, prepare for future, customer needs, autonomy, employee qualifications, culture, data use, management support, usability), Environmental factors (connectivity, transparency, collaboration, hybrid value creation, standards), Technology factors (infrastructure, reliability, relevance, adaptability, security, completeness, availability, real-time data)</td>
</tr>
<tr>
<td>[11]</td>
<td>Literature review</td>
<td>General organization</td>
<td>Supportive organizational culture, Well-managed transformation activities, Leveraging external and internal knowledge, Engagement of employees, IS capabilities, Dynamic capabilities, Digital business strategy, Aligned business and IS</td>
</tr>
<tr>
<td>[18]</td>
<td>Exploratory factor analysis</td>
<td>General organization</td>
<td>Customer centricity, Governance, Innovation, Resource attainment</td>
</tr>
<tr>
<td>[14]</td>
<td>Survey interview</td>
<td>Large private companies</td>
<td>Strategic vision, Strategic alignment, Culture of innovation, Know-how and intellectual property, Digital capability, Technology assets</td>
</tr>
<tr>
<td>[10]</td>
<td>Multiple case studies</td>
<td>Logistics service providers</td>
<td>Leadership, Supportive organizational culture, Employee and partner engagement, Aligning business and IT strategies, Process standardization and data integration, Employee training and skills development, Agile transformation management, Leveraging internal and external (technological) knowledge</td>
</tr>
<tr>
<td>[27]</td>
<td>Exploratory case study</td>
<td>Industrial firms</td>
<td>Innovation characteristics, External factors (the access to the thought leaders, consultants, and bridging organizations), Internal factors (top management, governance structure)</td>
</tr>
<tr>
<td>[5]</td>
<td>Regression analysis</td>
<td>SMEs</td>
<td>Information technology, Employee skills, Digital strategy</td>
</tr>
</tbody>
</table>

3. Theoretical Background, Conceptual Model, and Hypotheses

3.1. Resource-Based View and Resource-Dependence Theory

The resource-based view (RBV) posits that the competitive advantage of an enterprise comes from a combination of valuable, rare, imperfectly imitable, and irreplaceable resources and capabilities that are under its control [28]. The theoretical arguments of RBV highlight the management of firm resources as the basic units of analysis and indicate that resource heterogeneity across firms accounts for differential performance. For example, Verhoef et al. [29] state that DT is inherently multidisciplinary, as it involves changes in strategy, organization, information technology, the supply chain, and marketing, and each phase of the DT has its corresponding resources, structure, growth strategy, metrics, and
goals. A general consensus exists that DT requires a combination of multiple complementary resources. Therefore, the RBV provides a useful lens through which to view DT in SMEs [5].

Resource-dependence theory (RDT) provides directions for organizations to deal with external constraints. RDT characterizes corporations as an open system, dependent on contingencies in the external environment, and holds that to understand the behaviors of an organization, it is crucial to examine their ecology. RDT recognizes the influence of external factors on organizational behaviors, e.g., the need for interactions between firms, allowing each company to compete with rivals [30]. Regarding the subjects of this study, enterprises do not operate in isolation from the external environment. While acquiring resources and building capacities for DT, in addition to improving the efficiency of internal resource allocation, it continues to be necessary to pay attention to the acquisition of resources in the external environment and to adjust dependence on external resources to allow all available resources to be effectively mobilized to improve the level of DT.

In summary, the RBV is related to the concept of internal resources, and the RDT is related to external factors [30]. Through theoretical synthesis, it can be used to explain the relationship between resources and the performance of DT from a holistic perspective.

3.2. Proposed Conceptual Model and Hypotheses Formulation

Based on the existing research results, this study identifies six critical factors of successful DT, and draws on RBV and RDT to propose that 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, and employee skill positively moderates the relationship between organizational capabilities and DT. The conceptual model is shown in Figure 1.

![Figure 1. Conceptual model and research hypothesis.](image)

3.2.1. Environmental Factors

Using the RBV, SMEs show limited resources and capabilities, and often cannot compete with larger enterprises using their solitary resources and capabilities. Therefore, omitting the support of external parties, SMEs cannot achieve DT [4]. Realizing the significance and vitality of SMEs, many governments have provided policies, funding, specific programs, and counseling in their national economic plans to support and improve the conditions of SMEs and enable them to acquire performance growth and lasting competitiveness in markets [31]. Studies have shown that government policies and support
are important factors for the successful DT of enterprises [32]. The government can develop and strengthen policies and programs to support SMEs’ DT agenda, creating specific policies, support, and counseling initiatives, customized training programs, and collaboration ecosystems [33]. Moreover, the success of DT must also change organizations by creating a dynamic partner ecosystem [4]. In this ecosystem, an organization must show agility in building partnerships across industries as well as with customers. For inter-organizational relationships, RDT proves that the formation of inter-organizational relationships can help organizations acquire resources to reduce uncertainty and interdependence. Similarly, by establishing collaboration with their partners, SMEs can improve their business performance and achieve growth, even in the face of limited resources [34]. Thus, government support and partnerships, as important environmental factors, can have a significant impact on the success of DT. However, given the varying results of DT under the same environmental conditions, we have reason to doubt the validity of direct impact. According to RBV, only valuable, rare, incompletely imitable, and irreplaceable resources and capabilities can produce competitive advantages [28]. It can be understood that only when external resources are transformed into the unique capabilities of an organization can it create value. Therefore, we believe that external environmental factors influence the results of DT through organizational factors, and we propose the following hypotheses:

**Hypothesis 1 (H1).** Government support is positively related to digital strategy.

**Hypothesis 2 (H2).** Government support is positively related to top management.

**Hypothesis 3 (H3).** Partnership is positively related to digital strategy.

**Hypothesis 4 (H4).** Partnership is positively related to top management.

### 3.2.2. Technological Factors

Information technology is most important for companies to achieve DT [7], which is conducive to optimizing business processes, thereby creating customer and corporate value [29]. However, IT infrastructure itself is insufficient for gaining competitive advantage, because it is too easily imitated by other organizations, and it is their use within a specific context that enables firms to discover new ways to create value [7]. Consistent with this view, Carr [35] argues that unless a technology is proprietary to a company, it ultimately cannot provide a competitive advantage on its own; instead, technology should be a means to achieve strategically potent ends. When digital technologies enter an organization, they interact with organizational antecedents, organizational characteristics in particular (including the organizational strategy and legacy), and managerial characteristics (such as the top management team), to initiate DT [36].

The adoption of digital technologies widely permeates the organization, transcending traditional company boundaries, and it requires a strategy to coordinate the entire transformation to reach a defined goal [21]. On the other hand, advancements in technology have brought about changes in corporate economic value, business innovation, and competitive patterns and they have increasingly provided the foundation for digital strategies. Previous research generally indicates that digital technologies play a central role in creating and strengthening social and industry-level disruptions that trigger strategic responses in the organization [7]. In other words, digital technology induces new forms of business strategies by altering the value creation paths that organizations have previously relied upon to remain competitive, providing technical support for their effective implementation as well. In addition, IT can help enable leadership and organizational performance [37]. Investment in and use of IT infrastructure are considered to provide enhanced decision-making capabilities, increased efficiency, and improved productivity, playing an important role in management capabilities and corporate performance [38]. Research shows that when it is combined with organizational leadership, IT can develop unique organizational capabilities, thereby enhancing organizational performance [37]. Organizations must know how to use these tools properly in the form of IT functions and
be willing to do so. Therefore, we believe that technology is driving the company’s digital strategy and providing support to top management.

IT infrastructure resources and IT management capabilities are generally regarded as important IT strategic choices [39]. IT infrastructure resources are non-competitive resources, while IT management capabilities are competitive resources that it is difficult for competitors to imitate, such that organizations usually require an effective combination of IT infrastructure and IT management capabilities to obtain IT business value [40]. In summary, this research proposes the following hypotheses:

Hypothesis 5 (H5). IT infrastructure is positively related to digital strategy.
Hypothesis 6 (H6). IT infrastructure is positively related to top management.
Hypothesis 7 (H7). IT management capability is positively related to digital strategy.
Hypothesis 8 (H8). IT management capability is positively related to top management.

3.2.3. Organizational Factors

As the important guarantee and capabilities for the DT of enterprises, digital strategy and top management have attracted the most attention from researchers and practitioners [41]. Research and practical experience show that digital strategy is the key to the success of enterprises’ DT plans [42]. Organizations that digitally transform their business processes and organizational structures show a clear and coherent digital strategy [8]. By emphasizing digital leadership, agile and scalable digital operations, digital customer experience and emerging digital innovations, and coordinating the DT process, a digital strategy can support organizational transformations and achieve the expected goals of DT [23]. Recent research shows that companies require a digital strategy to coordinate all mandatory resources to achieve and enhance competitiveness [43]. On the contrary, the lack of a digital strategy leads to poor decision-making and a waste of resources [44].

In addition, the success of the enterprise is mostly contingent upon the motivation of the top managers and their abilities to develop successful resource recombination. A good leader is essential for any transformation, including DT [10]. According to Accenture’s data, 58% of leaders they interviewed said that their digital construction is in the charge of top managers, which also shows that the most important part is top management. On the one hand, the more that top managers support DT, the lower the resistance that the company will face in the internal integration process, which is more conducive to increasing the company investment in DT, seizing the benefits of DT, and the ability to predict future development [26]. On the other hand, managerial leadership is the primary factor for the success of DT [10]. The abilities of managers to continuously monitor market trends, perceive and seize technological opportunities, and turn them into business opportunities is more important than ever [2]. At the same time, as the coordinator of the change, the leaders encourage stakeholders to participate in the DT process and allocate resources appropriately, so that the DT can develop smoothly. As such, we propose that:

Hypothesis 9 (H9). Digital strategies have a positive effect on the success of the DT of SMEs.
Hypothesis 10 (H10). Top management has a positive effect on the success of DT of SMEs.

3.2.4. Effects of Employee Skill as a Moderator

Competitiveness and innovation lie in the skills and capabilities of the workforce. Indeed, the ability of a firm to remain competitive during uncertain times is largely due to the capacity of its employees to update previous skills and acquire new ones [45]. To carry out an appropriate DT, in particular, employees need to have or acquire adequate digital skills. Prior research shows that human factors can significantly impact DT capacity in an organization [46], so organizations must work to increase their employee’s skills. Organizations expect employees to be involved in continuous learning and must form a
team with the right blend of skills required by different projects [29]. Employee participation is an important condition for the implementation of a DT plan. Our investigation shows that maturing digital organizations build skills to realize the strategy. Digitally maturing organizations are four times more likely to provide employees with the needed skills than organizations at lower ends of the spectrum are [47]. Therefore, employee skill is among the key factors in the success of DT [48].

There is evidence that specific DT outcomes may be moderated by a host of personal, contextual, and cultural factors, which should be taken into account when implementing DT [49]. Employees are the most important executors of enterprises’ digital strategy and top management concepts, and their own skills and knowledge affect execution and the degree to which digital strategy and top management can affect the results of DT. Employees’ expectations of participation and competence are related to increased support and response for DT and affect its process. This study proposes the following hypotheses:

**Hypothesis 11 (H11).** Employee skill moderates the linkage between digital strategy and the success of SMEs’ DT.

**Hypothesis 12 (H12).** Employee skill moderates the linkage between top management and the success of SMEs’ DT.

### 4. Research Method and Data Analyses

#### 4.1. Measurement and Data Collection

This study uses a questionnaire survey to verify the research model. The measurement items are extracted from previous publications and reworded or modified to suit this study. The items for IT infrastructure and IT management capability are taken from Lu and Ramamurthy [50], including four measurement items respectively. The scale of digital strategy is adapted from Gurbaxani and Dunkle [14], with a total of five items. Top management refers to the level of corporate leaders’ support for DT and their own leadership assessment, so the scale refers to Wang et al. [51] and Mihardjo et al. [52]. The measurement items for government support are adapted from Wang, Xue, Liang, Wang, and Ge [51], including four items. The items of partnership are adapted from Sanders and Premus [53]. The items for DT are drawn from the work of Nwankpa and Roumani [54]. All items are measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). In addition, we used two control variables, such as industry and firm age, to explain the variance in the dependent variable.

The survey was conducted in China, so we invited three English-speaking experts whose native language is Chinese to translate the questions to ensure the accuracy of the translation. After the questionnaire was designed, a preliminary test was conducted with 20 questionnaires, which were distributed to SMEs owners and managers to evaluate the clarity, logical consistency, and effectiveness of the questionnaire. The survey questionnaires were distributed through a professional online questionnaire survey platform used by a large number of researchers that provides quality guarantees [55]. In our study, a total of 342 questionnaires were collected, 162 invalid questionnaires were removed, and 180 valid questionnaires were retained and used. Table 2 presents the descriptive statistics for the surveyed enterprises.

#### 4.2. Measurement Model

In this study, the structural equation modeling (SEM) method was used for data analysis. SEM is a comprehensive and effective method to verify the relationship between latent constructs and observed variables. It can measure the variance of latent variables more accurately and is widely used in empirical research in the fields of management and sociology. At present, there are two main estimation methods of SEM, namely, the covariance-based SEM and the variance-based SEM. Some researchers have posited that variance-based SEMs, such as partial least squares SEM (PLS-SEM), can analyze and explain the variance of dependent variables to the greatest extent, verify the relationship
between multiple variables in the same research model, and have fewer statistical identification issues than covariance-based SEM [56]. Moreover, it is ideally suited to models with relatively small sample sizes, and it can handle exploratory analyses and formative constructs [57]. Therefore, this study uses PLS-SEM for data analysis and model testing.

Table 2. Sample demographic information.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Items</th>
<th>Size/Percentage</th>
<th>Measure</th>
<th>Items</th>
<th>Size/Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>Agriculture, Forestry, Animal Husbandry, and Fishery</td>
<td>5, 2.7%</td>
<td>Measure</td>
<td>Firm scale (people)</td>
<td>21–50</td>
</tr>
<tr>
<td></td>
<td>Industry and Construction</td>
<td>54, 30%</td>
<td></td>
<td>51–100</td>
<td>18, 10%</td>
</tr>
<tr>
<td></td>
<td>Wholesale and Retail Trade</td>
<td>13, 7.2%</td>
<td></td>
<td>101–300</td>
<td>33, 18.3%</td>
</tr>
<tr>
<td></td>
<td>Accommodation and Catering Industry</td>
<td>7, 3.8%</td>
<td></td>
<td>301–1000</td>
<td>62, 34.4%</td>
</tr>
<tr>
<td></td>
<td>Transportation, Storage, and Post</td>
<td>12, 6.6%</td>
<td></td>
<td></td>
<td>15, 8.3%</td>
</tr>
<tr>
<td></td>
<td>Information Transmission, Software, and Information Technology Services</td>
<td>70, 38.8%</td>
<td>Annual revenue (million)</td>
<td>Less than 1</td>
<td>3, 1.6%</td>
</tr>
<tr>
<td>Firm age (year)</td>
<td>Less than 3</td>
<td>19, 10.5%</td>
<td>1–5</td>
<td>15, 8.3%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3–5</td>
<td>23, 12.7%</td>
<td>5–10</td>
<td>34, 18.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6–10</td>
<td>57, 31.6%</td>
<td>10–50</td>
<td>52, 28.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>More than 10</td>
<td>99, 55%</td>
<td>50–100</td>
<td>28, 15.5%</td>
<td></td>
</tr>
<tr>
<td>Firm scale (people)</td>
<td>20 and below</td>
<td>3, 1.6%</td>
<td>100–500</td>
<td>30, 16.6%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>More than 500</td>
<td>18, 10%</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Using Smart PLS 3.0 software to test the reliability and validity, the results are shown in Table 3. Reliability is assessed with Cronbach’s alpha ($\alpha$), composite reliability (CR), and average variance extracted (AVE). The results for the quality criteria are shown in Table 3. All $\alpha$ and CR values exceed the thresholds of 0.70, and all AVE values are above the recommended threshold of 0.50, so all the indicators show good reliability. We use factor loading and the square root of the AVE to measure convergent validity and discriminant validity, respectively. The results show that all of the factor loadings are greater than 0.7 at a significance level of $p < 0.01$, suggesting good convergent validity, and the square root for each factor’s AVE is larger than the correlation coefficients with other factors (Table 3), which confirms discriminant validity.

Table 3. Descriptive statistics and inter-construct correlations.

<table>
<thead>
<tr>
<th>Items</th>
<th>Cronbach’s Alpha</th>
<th>CR</th>
<th>AVE</th>
<th>DS</th>
<th>DT</th>
<th>GS</th>
<th>ITI</th>
<th>ITM</th>
<th>PA</th>
<th>TM</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS</td>
<td>0.823</td>
<td>0.876</td>
<td>0.587</td>
<td>0.766</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DT</td>
<td>0.707</td>
<td>0.837</td>
<td>0.631</td>
<td>0.688</td>
<td>0.795</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GS</td>
<td>0.812</td>
<td>0.876</td>
<td>0.638</td>
<td>0.597</td>
<td>0.548</td>
<td>0.799</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITI</td>
<td>0.767</td>
<td>0.851</td>
<td>0.589</td>
<td>0.646</td>
<td>0.463</td>
<td>0.382</td>
<td>0.768</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITM</td>
<td>0.789</td>
<td>0.864</td>
<td>0.614</td>
<td>0.794</td>
<td>0.633</td>
<td>0.588</td>
<td>0.542</td>
<td>0.784</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA</td>
<td>0.728</td>
<td>0.846</td>
<td>0.648</td>
<td>0.623</td>
<td>0.669</td>
<td>0.595</td>
<td>0.523</td>
<td>0.686</td>
<td>0.805</td>
<td></td>
</tr>
<tr>
<td>TM</td>
<td>0.804</td>
<td>0.885</td>
<td>0.719</td>
<td>0.619</td>
<td>0.648</td>
<td>0.397</td>
<td>0.436</td>
<td>0.601</td>
<td>0.591</td>
<td>0.848</td>
</tr>
</tbody>
</table>

Note(s): digital strategy (DS); digital transformation (DT); government support (GS); IT infrastructure (ITI); IT management capability (ITM); partnership (PA); top management (TM).

4.3. Structural Model

To ensure consistency of the estimation, the consistent PLSs estimation method, and PLSs bootstrapping (N = 5000) were separately used to estimate the coefficients and their significance of each path. Figure 2 shows the path coefficients in the test results obtained using structural modeling. In the environment dimension, it was found that government support has a positive effect on digital strategy ($\beta = 0.169, t = 2.2, p < 0.05$), and the partnership positively affects top management ($\beta = 0.325, t = 3.053, p < 0.01$), so Hypothesis 1 (H1) and Hypothesis 4 (H4) are supported. The relationships between government support and top management and between partnership and digital strategy are not significant, so
Hypothesis 2 (H2) and Hypothesis 3 (H3) are rejected. In the technological dimension, IT infrastructure has a significant positive impact on digital strategy ($\beta = 0.288, t = 3.891, p < 0.001$), but not on top management, so Hypothesis 5 (H5) is valid, while Hypothesis 6 (H6) is not supported. IT management capability has positive effect on both digital strategy ($\beta = 0.535, t = 7.616, p < 0.001$) and top management ($\beta = 0.351, t = 3.258, p < 0.001$), so Hypothesis 7 (H7) and Hypothesis 8 (H8) are both supported. In the organizational dimension, it was found that both digital strategy ($\beta = 0.465, t = 6.591, p < 0.001$) and top management ($\beta = 0.361, t = 5.138, p < 0.001$) have a significantly positive effect on DT, which supports the acceptance of H9 and Hypothesis 10 (H10). The control variables, industry, and firm age did not significantly affect the dependent variables.

Figure 2. Results of structure model analysis.

4.4. Mediating Effect

This study uses the generally accepted bootstrap method to test the mediating effects of organizational factors (digital strategy and top management) between environmental factors, technological factors, and DT. We use the PROCESS SPSS macro developed by Hayes to test mediation, using the bias-corrected method and the percentile method to test the mediating effect, and the confidence level for the confidence intervals is 95%. The results are shown in Table 4. Following the criterion of mediating effect from [58], we conclude that organizational factors (digital strategy and top management) act as a partial mediator between environmental factors (government support and partnership) and DT performance, as well as between technology factors (IT infrastructure and IT management capability) and DT. In particular, digital strategy acts as a full mediator between IT infrastructure and DT.

4.5. Moderating Effect

This study uses multilevel regression analyses to explore the moderating role of employee skill between organizational factors and DT. The results are respectively shown in Tables 5 and 6. In Table 5, Model 1 presents the effect of digital strategy on DT. Model 2 presents the effects of both digital strategy and employee skill on DT, and Model 3 presents the effects of digital strategy, employee skill, and their interaction effect on DT. Thus, R-square change simply indicates the variation in constructs’ explanatory power regarding DT. In this study, we analyze the moderating role of employee skill, and its most important result is in giving the interaction effects. It is found that employee skill positively moderates...
the relationship between digital strategy (Table 5), top management (Table 6), and DT, so Hypothesis 11 (H11) and Hypothesis 12 (H12) are both supported.

Table 4. Results of mediating effects.

<table>
<thead>
<tr>
<th>M/(IV)/(DV)</th>
<th>Items</th>
<th>Effect</th>
<th>Coefficient</th>
<th>Bias-Coefficient</th>
<th>Percentile</th>
<th>Mediation Existence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direct effect</td>
<td>0.230</td>
<td>0.066</td>
<td>3.509</td>
<td>0.101</td>
<td>0.359</td>
</tr>
<tr>
<td></td>
<td>Indirect effect</td>
<td>0.321</td>
<td>0.057</td>
<td>5.632</td>
<td>0.224</td>
<td>0.445</td>
</tr>
<tr>
<td>DS/(ITI)/(DT)</td>
<td>Direct effect</td>
<td>0.037</td>
<td>0.072</td>
<td>0.521</td>
<td>−0.104</td>
<td>0.179</td>
</tr>
<tr>
<td></td>
<td>Indirect effect</td>
<td>0.424</td>
<td>0.056</td>
<td>7.571</td>
<td>0.322</td>
<td>0.550</td>
</tr>
<tr>
<td>DS/(ITM)/(DT)</td>
<td>Direct effect</td>
<td>0.244</td>
<td>0.088</td>
<td>2.764</td>
<td>0.070</td>
<td>0.417</td>
</tr>
<tr>
<td></td>
<td>Indirect effect</td>
<td>0.389</td>
<td>0.078</td>
<td>4.987</td>
<td>0.263</td>
<td>0.569</td>
</tr>
<tr>
<td>TM/(PA)/(DT)</td>
<td>Direct effect</td>
<td>0.444</td>
<td>0.064</td>
<td>7.099</td>
<td>0.321</td>
<td>0.568</td>
</tr>
<tr>
<td></td>
<td>Indirect effect</td>
<td>0.226</td>
<td>0.049</td>
<td>4.612</td>
<td>0.137</td>
<td>0.336</td>
</tr>
<tr>
<td>TM/(ITM)/(DT)</td>
<td>Direct effect</td>
<td>0.383</td>
<td>0.064</td>
<td>5.824</td>
<td>0.253</td>
<td>0.513</td>
</tr>
<tr>
<td></td>
<td>Indirect effect</td>
<td>0.249</td>
<td>0.049</td>
<td>5.082</td>
<td>0.161</td>
<td>0.351</td>
</tr>
</tbody>
</table>

Notes: independent variable (IV); mediator (M); dependent variable (DV); digital strategy (DS); digital transformation (DT); government support (GS); IT infrastructure (ITI); IT management capability (ITM); partnership (PA); top management (TM).

Table 5. Analysis of moderating role of employee skill in the relationship between digital strategy and DT.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>β</td>
<td>T Value</td>
<td>β</td>
</tr>
<tr>
<td>Main effect</td>
<td>digital strategy</td>
<td>0.683</td>
<td>12.489</td>
<td>0.516</td>
</tr>
<tr>
<td></td>
<td>employee skill</td>
<td>0.235</td>
<td>3.071</td>
<td>0.246</td>
</tr>
<tr>
<td>Moderating effect</td>
<td>× employee skill</td>
<td>0.114</td>
<td>2.053</td>
<td></td>
</tr>
<tr>
<td>Adjusted R squared</td>
<td>0.464</td>
<td>0.488</td>
<td>0.497</td>
<td></td>
</tr>
<tr>
<td>R squared change</td>
<td>0.467</td>
<td>0.027</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>F change</td>
<td>155.976 ***</td>
<td>9.432 ***</td>
<td>4.216 *</td>
<td></td>
</tr>
</tbody>
</table>

*** p < 0.001; ** p < 0.01; * p < 0.05.

Table 6. Analysis of moderating role of employee skill in the relationship between top management and DT.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>β</td>
<td>T Value</td>
<td>β</td>
</tr>
<tr>
<td>Main effect</td>
<td>top management</td>
<td>0.645</td>
<td>11.269</td>
<td>0.444</td>
</tr>
<tr>
<td></td>
<td>employee skill</td>
<td>0.340</td>
<td>5.111</td>
<td>0.329</td>
</tr>
<tr>
<td>Moderating effect</td>
<td>× employee skill</td>
<td>0.206</td>
<td>3.556</td>
<td></td>
</tr>
<tr>
<td>Adjusted R squared</td>
<td>0.413</td>
<td>0.486</td>
<td>0.517</td>
<td></td>
</tr>
<tr>
<td>R squared change</td>
<td>0.416</td>
<td>0.075</td>
<td>0.034</td>
<td></td>
</tr>
<tr>
<td>F change</td>
<td>126.983 ***</td>
<td>26.126 ***</td>
<td>12.647 ***</td>
<td></td>
</tr>
</tbody>
</table>

*** p < 0.001; ** p < 0.01; * p < 0.05.

Figure 3 shows that employee skill affects the relationship between digital strategy and DT. In Figure 3, the x-axis gives the extent of digital strategy, and the y-axis gives the extent of DT. The dashed line and the continuous line indicate the relationship between digital strategy and DT under conditions of high employee skill and low employee skill, respectively. The same meaning for employee skill is shown in Figure 4. This confirms that employee skill can moderate the relationship between organizational factors and DT.
This study contributes to the understanding of the antecedents and processes of DT in SMEs and helps SMEs to carry out scientific and effective resource allocation in the process of DT. This study empirically examines the impact mechanism of seven key resources from three dimensions of technology (IT infrastructure and IT management capacity), organization (digital strategy, top management, employee skills), and environment (government support and partnership) on DT. The results suggest some important findings.

First, from the perspective of technology, neither IT infrastructure nor IT management capabilities can directly affect DT, but through the intermediary role of organizational capabilities (digital strategy, top management), and then have a positive impact on DT. This suggests that technology is a prerequisite for DT, and DT is impossible without suitable technology, however, only driving technology forward is not enough to gain benefits from DT [26]. It is important to leverage enterprise IT resources to support and adapt to digital strategies and top management capabilities. This result is consistent with the complementary view of RBV that IT resources by themselves cannot generate competitive advantages, unless IT is effectively integrated with the business and management of the enterprise and evolves into an irreplaceable dynamic capability to realize IT value [7,37]. This can explain why many companies have made intelligent investments, but not achieved the
expected returns. IT infrastructure and IT management capabilities bring about the changes of enterprise business innovation and competitive models, induce new forms of business strategies, and provide necessary technical support for the effective implementation of digital strategies [36]. This supports the view of Carr [35] that technology is a means. In addition, the combination of IT management capabilities and organizational leadership can improve decision-making capabilities and efficiency, thereby improving the level of digital transformation implementation. Therefore, organizations must know how to correctly tap the value of these tools in the form of IT functions, and the compatibility between new technology and digital strategy plays a significant role in the implement of DT.

Secondly, we confirm the general view in the existing scholarship that digital strategy and top management are the key factors for the success of DT [5,24,25]. Enterprises with digital strategies, as well as top management support and leadership, are more likely to achieve DT. With an emphasis on digital leadership, agile and scalable digital operations, digital customer experience and emerging digital innovations, and coordinating the DT process, a digital strategy can support organizational transformation and achieve the expected goals of DT [23]. This is consistent with prior research suggesting that companies should adopt a digital strategy to coordinate all mandatory resources to achieve and enhance competitiveness [43]. It is also in line with the practical experience that SMEs undergoing a transformation are more likely to follow a plan [59], and the lack of a digital strategy leads to poor decision-making and a waste of resources [44]. Additionally, top management also has a positive effect on the success of DT, which validates existing research [26]. A good manager is constantly sensing and seizing technological and market opportunities to translate them into business opportunities, is able to support and motivate employees and partners to be active parts of the DT process, and also provides execution and very strong governance to move the transformation forward [10].

Moreover, this study found that employee skill positively moderates the relationship between organizational factors (digital strategy and top management) and DT. This means that the companies with a high proportion of qualified employees are more likely to achieve DT, which also confirms the findings of recent studies that digitalization depends on human capital as well as technological resources [60]. Empirical examination shows that employee skill does not directly affect DT, but their high-tech absorptive and innovation capabilities enhance the impact of digital strategy and top management on DT. The implementation of digital projects usually requires well-educated employees, and existing literature suggests that skilled employees are necessary for disruptive digitalization [60]. Furthermore, based on a shared enthusiasm and digital identity [5] those employees are central to rebuilding values, norms, and organizational behavior during the transformation process [61].

Finally, regarding the effect of environment, government support and partnership resources complement each other, and influence DT by influencing enterprise digital strategy and top management capabilities respectively. The government supports and promotes the formulation and implementation of digital strategies for SMEs by providing funding, policies, counseling and programs, and other assistance [33]. This result verifies the effectiveness of relevant government policies and is consistent with the development characteristics of Chinese enterprises. Generally speaking, the development of SMEs in China is greatly influenced by the government’s guidelines, and it is highly possible to change the enterprise’s strategy to respond to the government’s development plans and move towards the DT road [62]. However, government support does not improve top management. The possible explanation is that the government strategy ignores the digital literacy of corporate executives, which is related to the way the government supports it. As a complement, the partnership can just make up for the shortcomings in this area. Cooperation and collaboration with customers, suppliers, IT providers, and stakeholders contribute to knowledge sharing, which will enrich the decision-making capabilities of managers. Value co-creation behavior (such as jointly formulating plans, solving problems together, and making flexible adjustments) between partners can effectively reduce decision-making errors and positively promote the improvement of top management. However,
the impact of the partnership on digital strategy is not supported, which shows that most of the cooperation between enterprises is in the business aspect, and does not touch the core strategic level. Enterprises need to work together to create stronger value chains for DT [26].

6. Conclusions and Implications

SMEs are lagging behind large companies in digitalization, which has a negative impact on performance. Although SMEs are economically important, people know little about the key resources and process mechanisms for the successful DT in SMEs. We set three goals to address this knowledge gap. Based on the complementary RBV, we first identified the main resources in three dimensions: technology (IT infrastructure, IT management capabilities), organization (digital strategy, top management, and employee skills), environment (government support, partnerships). Secondly, we empirically tested the interrelationship between these factors and their impact on DT. Then, we investigated whether employee skills moderate the effect of organizational capabilities on DT. The results of the survey of 180 Chinese SMEs show that technological and environmental resources promote the improvement of organizational capabilities, and organizational capabilities are positively correlated with DT, and mediate the impact of technological and environmental resources on DT. Employee skill is one of the reasons for the difference in corporate value. This study contributes to our knowledge of the resources that need to be configured for this transformation process, and how to make use of their value, and then help managers to develop more effective strategies addressing the complexity arising from DT.

6.1. Research Implications

This research has certain theoretical implications. First, this study enriches the research in the fields of IT, strategic management, and DT by exploring the mechanism of DT’s multiple factors. Most existing studies use qualitative analysis or case studies to identify key factors [10,11,32], lacking the universality of empirical verification, and some studies determine the value of factors by examining the direct impact of various factors on DT [5], ignoring the complexity of DT. Based on the complementary resource-based theories, this study fully considers technological, organizational, and environmental resources, identifies the key elements for the success of DT in SMEs, and examines the relationship between the three-dimensional factors and their influence mechanism on DT. Our findings can deepen the understanding of the value creation of technology and environmental resources, further revealing the complex mechanism of enterprises’ DT process, thus enriching the research in related fields.

Secondly, this study provides a new perspective for understanding the impact of employee skill on DT. Existing literature suggests that skilled employees are necessary for disruptive digitalization [5,60], but there lacks discussion of its impact mechanism. This study empirically examines the complementary effects of employee skills and other factors and finds that employee skills do not directly promote DT, but by enhancing the impact of digital strategy and top management on DT, that is, employee skill positively moderates the relationship between organizational capabilities and DT. This finding enriches the cognition of employee skill on DT and the boundary conditions of DT.

Finally, this study takes SMEs as the research object, enriches the DT knowledge of SMEs. Existing DT research mainly focuses on large enterprises, manufacturing industries, and other enterprises with resource advantages, but lack sufficient understanding of DT in SMEs [16]. This study focuses on the DT problem of SMEs, explores its key resources and transformation mechanism, thus filling the gaps in the relevant literature.

6.2. Management Implications

From the study findings, at least three important implications are worthy of practitioners’ consideration to promote DT in SMEs:
First, the key for managers is to understand what resources need to be configured for the transformation process. Based on existing research results, this study identified seven key resources that affect the success of DT in SMEs from a systematic perspective, which helps managers understand the success factors more clearly, and can be used to evaluate the company’s readiness for DT, identifies and improves the areas of resource weakness and pre-employment supports firm decision-making, thus increasing the possibility of successful DT.

Secondly, this study helps managers to develop more effective strategies addressing the complexity arising from DT. This study empirically tested the influence mechanism of each element on DT. The acquisition of enterprise IT resources and external resources (government support, partnerships) is crucial to the implementation of DT, but its value needs to be enhanced through organizational capabilities. When carrying out resource allocation and planning, managers should pay attention to the matching of technology, business, and strategy [63], and actively embed in the upstream and downstream industrial chain to achieve value co-creation [26], so as to support the formulation and implementation of the enterprise digital strategy [64]. Based on this, managers can know whether to address and optimize the complexity caused by the interaction of various factors.

Finally, SME managers need to support and train employees to acquire the necessary digital skills [60]. This will naturally change their existing roles and also affect the identities of employees and the identity of the organization as a whole [65]. Managers need to support employees to develop accordingly [66] and create a digital-related identity and role within the organization [67].

6.3. Limitations and Further Research

Although we have sought rigor throughout this study, some limitations remain that must be considered when interpreting the findings and conducting future research. First, the survey objects of this study are 180 local Chinese SMEs. The uniqueness of the regional scenario and the limited sample size implies that the study results must be further verified, which can be regarded as a limitation. Future research can consider using larger samples in a wider range to improve the generality of the conclusions. In addition, the study is also limited in that it did not verify the impact and relationship of many more factors [68]. This study only explores the impact relationships among six critical factors, thus reducing the complexity of DT. Future research should include additional factors into their model. For example, technological innovation, dynamic capabilities, corporate cultures and structures, industrial vitality, and others could be reviewed. Finally, this study does not conduct an in-depth analysis by industry. Although we take the industry as a control variable and find that its influence on the dependent variable is not significant, the digital transformation of different industries has its own unique characteristics, and the analysis of specific industries will have greater practical significance.

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Conflicts of Interest: The authors declare no conflict of interest.
References


47. Kane, G. The technology fallacy: People are the real key to digital transformation. *Res. Technol. Manag.* 2019, 62, 44–49. [CrossRef]