

Article

ERP Usage and Firm Performance: Evidence from Chinese SMEs

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Abstract

Enterprise resource planning (ERP) systems are popular and associated with increased organizational performance, but the channels by which ERP utilization affects firm performance are not fully known. This study investigates how ERP use relates to the performance of Chinese SMEs and examines customer relationship management (CRM), knowledge management (KM), and top management commitment (TMC) as parallel mediators. The analysis further tests the hypothesis that technophobia undermines the positive association between ERP use and knowledge management. PLS-SEM was used to analyze cross-sectional survey data of 600 ERP users. ERP usage was positively associated with firm performance, and CRM, KM, and TMC mediated this relationship. Technophobia significantly weakened the ERP-KM relationship. These results indicate that ERP systems improve the performance of firms not only through the integration of operations but also through customer- and knowledge-related processes and leadership processes. The findings emphasize the role of managers in complementing ERP investments with robust CRM practices, management support, and knowledge-sharing systems, as they deal with employee anxiety about technology. This study contributes to ERP research by demonstrating that the performance results associated with ERP in SMEs are contingent on the alignment of customer, managerial, and knowledge-based processes and that technophobia is a boundary condition that selectively limits the processes facilitated by ERP.

Keywords: enterprise resource planning; knowledge management; technophobia; organizational learning; digital transformation



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1. Introduction

Enterprise Resource Planning (ERP) systems are prevalent in SMEs, yet the internal processes of how ERP utilization is connected to performance are not well explained [1,2]. ERP enhances data quality and real-time visibility by integrating core business functions (finance, operations, supply chain, HR, sales) [3,4]. In competitive environments, these features enable greater organizational responsiveness to operational disruptions and more timely strategic decision-making [5,6]. ERP also supports standardization, compliance, and analytics, which help shape workflows and coordination [7–9]. These characteristics are important since ERP can affect performance through customer-facing, leadership, and knowledge processes [10,11].

Although previous research indicates a consistent positive association between ERP systems and operational, financial, and customer-related performance [12,13], little is known about the internal processes linking ERP use to firm performance, with the existing studies tending to focus on the processes individually. Much of the literature focuses on mediators like customer relationship management, top management commitment, and knowledge management; little is understood about how these organizational mechanisms work together. Consequently, previous studies offer an incomplete explanation of how ERP systems bring performance effects, especially in SMEs, where the processes within the organization are closely intertwined and less formally structured. Studies show that ERP use is associated with shorter cycle times, fewer errors, and reduced coordination barriers [14], while ERP-enabled CRM is associated with better customer interaction, data quality, and loyalty [15–18]. Similarly, leadership support has been identified as one of the factors that are related to the successful introduction of ERP systems and their interconnection with organizational performance. Knowledge management practices, including creation, sharing, and application of knowledge, are linked to transforming information created by ERP into better decision-making and learning [10,19]. However, minimal research has investigated CRM, TMC, and KM in a combined empirical framework, although they may be used concurrently as complementary processes related to the use of ERP.

Besides organizational mechanisms, psychological factors that influence the use of ERP have not been given the due consideration they deserve. User-related factors such as technophobia can limit effective ERP use and prevent the development of knowledge-sharing routines. Recent research on technology acceptance indicates that the use of systems is linked to the perception of usefulness, ease of use, and comfort of users with digital tools [20–22]. If employees have anxiety surrounding technology, the desire to engage with ERP applications might be lower, and this may potentially decrease the effectiveness of ERP-enabled knowledge sharing and problem-solving [23,24]. Some studies observe that such negative interpretations about technology may be linked to harming the value of knowledge management systems, as well as hindering digital transformation [25–27]. This gap suggests that a theoretical model should be used in which there are internal organizational processes and boundary conditions, such as technophobia.

The problems are particularly important to small and medium-sized enterprises (SMEs), which tend to have limited resources, uneven digital awareness, and flexible management structures. SMEs tend to have less formal communication networks, less standardized processes, and different degrees of technological sophistication than larger firms. These features can influence the usage of ERP systems and the way their benefits can be realized. In the case of SMEs, CRM, TMC, and KM serve as key channels linking ERP usage to performance improvements. Leadership participation tends to be more direct, relationships with customers can be based on speed of response, and sharing of knowledge can be affected by personal contact as opposed to an institutional process. Furthermore, there might be significant differences in digital knowledge among employees in SMEs, which increases the importance of technophobia as a moderating variable.

In the meantime, Chinese SMEs commonly face resource constraints, limited IT staff, and uneven digital capabilities. They experience tough competition, shorter production cycles, and rising demands of both local and international markets [28–30]. These circumstances render the advantages of ERP implementation incredibly sensitive to organizational resources, leadership agendas, and employee readiness. The hierarchical decision-making and the dependence on managerial advice are also cultural features that may contribute to the importance of TMC in shaping the ERP outcomes. Moreover, the differences in digital literacy levels, especially among older workers, contribute to technophobia becoming a

relevant aspect that influences the knowledge-based benefits of ERP systems [31,32]. While research on ERP adoption in China is expanding, studies rarely integrate organizational mechanisms and behavioral moderators into a single explanatory framework. This study addresses this gap by providing empirical evidence from Chinese SMEs, highlighting interactions influenced by cultural and economic factors. It builds upon and extends prior research on ERP in Chinese SMEs, and mediation models (e.g., KM and top management support in ERP contexts), by simultaneously testing three parallel mediators (CRM, TMC, KM) together with technophobia as a psychological moderator—an integration that remains limited in the literature despite growing recognition of technology anxiety as a barrier (e.g., studies on technostress and adoption in SMEs) [4,33].

We draw on RBV and KBV to frame ERP usage as a resource whose value depends on complementary capabilities. Under RBV, ERP is a resource that supports integration and information flows [34,35]. RBV predicts performance gains only when ERP usage is paired with complementary capabilities. We model CRM, top management commitment, and KM as complementary capabilities [36]. KBV highlights knowledge processes as a key route to performance. ERP can enable KM by providing timely, integrated information. Whether this information is used well depends on leadership support and knowledge-sharing routines. Section 2.1 details this combined logic; here, it motivates the model.

The study incorporates technophobia through the technology acceptance model (TAM) and moderation theory to consider the effects of the boundary conditions [37,38]. Employees who feel discomfort or anxiety toward digital technologies are less likely to explore ERP functionalities or contribute to knowledge-sharing practices. High technophobia is expected to weaken the effect of ERP usage on KM by reducing system usage, limiting learning, and constraining the effectiveness of knowledge integration. This moderating perspective is consistent with studies stating that psychological barriers can impede the benefits of digital systems, even when technological resources are in place [39,40]. For these reasons, technophobia is theorized as a factor associated with weakening the relationship between ERP usage and KM, thereby influencing downstream associations with firm performance. This integration of TAM with RBV/KBV provides an extended multilevel framework for ERP research in SMEs, building on how KBV can modify TAM by emphasizing knowledge as a mediator influenced by user attitudes.

Building on these gaps, we examine how ERP usage relates to firm performance in Chinese SMEs through multiple organizational mechanisms. Specifically, we test CRM, top management commitment, and KM as parallel mediators, and technophobia as a moderator of the ERP usage–KM relationship. This specification reflects how SMEs often develop customer, managerial, and knowledge routines at the same time rather than in a fixed sequence. It also brings a user-level boundary condition into the model. Accordingly, the study pursues three objectives:

- The direct ERP usage–performance association.
- Whether CRM, top management commitment, and KM mediate that association.
- Whether technophobia moderates the ERP usage → KM relationship.

Together, these tests clarify when and how ERP usage is linked to performance in Chinese SMEs. First, the theoretical novelty of this study lies not in combining constructs but in the structural logic connecting them. Prior ERP research has examined CRM, TMC, and KM in separate studies, producing fragmented evidence that cannot rank their relative importance. Our parallel mediation design solves this problem by placing all three pathways in direct competition. Specifically, the results show that CRM is the strongest mediator, followed by TMC and KM, a comparative ranking that single-mediator designs are structurally unable to produce [2,41]. Beyond this, the parallel structure reflects how ERP operates in practice. When ERP usage increases in an SME, customer processes, lead-

ership alignment, and knowledge flows all improve simultaneously. A sequential model would assume one pathway activates another, which is inconsistent with how tightly coupled SME processes actually work. The parallel design is therefore theoretically justified, not just methodologically convenient. The framework also maps three theories to three distinct organizational levels through one technology: RBV explains how ERP enables top management commitment as a managerial resource; KBV explains how ERP strengthens knowledge management as a knowledge process; and TAM explains how technophobia constrains the ERP–KM link at the user level. Few prior ERP studies have examined CRM, top management commitment, and knowledge management as simultaneous mediating pathways within a single model [3,42]. Second, technophobia is introduced as a psychological moderator of the specific ERP-to-KM pathway rather than of adoption intention. Third, the Chinese SME context is treated not as a neutral replication setting but as a theoretically meaningful environment where institutional pressures, resource constraints, and technology skepticism interact in ways that are absent from Western or large-enterprise samples [42]. Section 2 develops the hypotheses for this integrated framework.

2. Literature Review and Conceptual Model

2.1. Theoretical Foundation

We draw on RBV, KBV, and TAM to explain how ERP usage relates to performance via organizational capabilities and user attitudes. RBV treats ERP as an enabling resource whose effects depend on complementary capabilities [2,4,6,34]. RBV also implies that adoption alone is insufficient; value comes from how ERP is used and embedded [36,43,44]. Accordingly, we model CRM, top management commitment, and KM as complementary capabilities that help convert ERP-enabled information into performance. For instance, a strong CRM is linked to translating integrated customer data into improved service and loyalty [45].

KBV points out that the ability to develop, retain, disseminate, and leverage knowledge is a primary pathway to a firm's competitive advantage, and ERP can facilitate this through better information integration and visibility [46,47]. These gains, however, depend on how well the system is embedded in organizational routines [48,49]. Our study applies KBV by examining associations between ERP usage and KM capabilities, with KM as a mediator. This is relevant for SMEs, where flexible knowledge sharing is crucial [50–52]. Together, RBV and KBV suggest that ERP usage creates value when ERP-generated information is absorbed into organizational routines. CRM uses customer information to improve service response, relationship quality, and retention. KM turns operational information into knowledge that can be stored, shared, and applied across departments. TMC supports both processes by allocating resources, setting priorities, and encouraging employees to use ERP in daily work. These three mechanisms therefore represent different but related ways through which ERP usage may be associated with firm performance [53,54].

We extend TAM by treating technophobia as a user-level condition that can reduce comfort with ERP use and limit engagement with ERP-supported KM activities [21,39,40]. In this model, TAM does not replace RBV or KBV; instead, it explains why ERP-enabled resources and knowledge processes may not produce the same outcomes across users. Employees who feel anxious about digital technologies may use fewer ERP functions, avoid system-based knowledge sharing, or rely on informal routines even when integrated information is available. This link is especially relevant in Chinese SMEs, where digital literacy may differ across age groups, departments, and levels of ERP exposure [31].

The technology–organization–environment (TOE) Framework [55] is used here only as contextual support for the Chinese SME setting. TOE helps explain why ERP usage in SMEs is shaped by technological readiness, organizational resources, and external competitive

pressure [30,33]. The main theoretical logic of the model remains grounded in RBV, KBV, and TAM: RBV explains the capability-based pathways, KBV explains the knowledge pathway, and TAM explains the moderating role of technophobia on ERP-enabled KM [3].

2.2. Hypothesis Development and Research Model

Drawing on the theoretical foundation in Section 2.1, the following hypotheses examine how ERP usage relates to firm performance in Chinese SMEs through both organizational capabilities and individual psychological factors.

2.2.1. ERP Usage and Firm Performance (H1)

ERP systems have been described as integrating platforms, which enable companies to align operations, discover similarities in processes, and get real-time data across functional boundaries. Within the RBV paradigm, ERP systems are strategic technology tools whose association with operational performance and organizational response depends on how they are actively used and embedded in organizational routines [46,56,57]. Although Feng and coworkers (2024) discuss RBV, they also write that resources do not generate any performance advantages unless they are applied and integrated into organizational practices [42]. Accordingly, the extent to which companies actively use ERP rather than simply having it installed is essential in judging its effects on performance [42].

Previous studies indicate that increased use of ERP is associated with greater accuracy in operations, cost management, decision quality, and process transparency [50,58]. ERP usage is associated with fewer data discrepancies and greater cross-departmental coordination. Effective use of ERP can be especially significant in SMEs, where resource constraints and informal organization are common, to compensate for limited managerial and analytical capacity [34]. Despite these advantages, ERP systems do not automatically translate into superior performance outcomes [30,33]. Their impact depends on how extensively and effectively they are integrated into daily operations and decision-making processes [3]. As a result, ERP usage is expected to be positively associated with firm performance, operating through complementary organizational processes rather than a direct technological effect [59]. From an RBV perspective, ERP systems qualify as strategic resources because they enable firms to integrate processes across functions in ways that are embedded within the organization and difficult for competitors to replicate [34]. This embeddedness means ERP value is path-dependent, not immediate, which is why usage must be sustained to produce measurable performance outcomes. Therefore, we hypothesize:

H1. *ERP usage has a positive relationship with firm performance.*

2.2.2. Mediating Role of Customer Relationship Management (H2)

ERP systems support Customer Relationship Management since they can consolidate all the customer data within diverse functional departments, which is a better way to improve service quality, retention, and loyalty [60–62]. ERP-enabled CRM turns integrated information into actionable customer insights. This assists firms in comprehending customer needs, customizing offerings, and establishing better, enduring relationships [63,64].

In SMEs, where relationships with customers may be based on quick responsiveness and personalized attention, CRM is associated with enhanced customer interactions and revenue generation through ERP-enabled informational efficiencies [59]. ERP-integrated CRM enables companies to respond more quickly to queries and complaints, handle them more effectively, and build customer trust through automated sales and service. This increased customer satisfaction and loyalty is associated with adding to the firm's performance in terms of sales, repeat business, and positive word-of-mouth. Under RBV, CRM is a complementary capability that transforms ERP-generated data into a firm-specific,

inimitable asset. Because the customer knowledge embedded in ERP-enabled CRM routines is organizationally contextual and hard to imitate, it produces a competitive advantage that generic CRM tools alone cannot replicate [34,36]. CRM cannot be considered as a simple operational tool but a strategic bridge that relates the transformation of the internal efficiencies of ERP to the external market success. Therefore, we hypothesize:

H2. *Customer relationship management mediates the positive relationship between ERP usage and firm performance.*

2.2.3. Mediating Role of Top Management Commitment (H3)

ERP success and its performance implications depend heavily on top management commitment. Executive support provides organizational readiness, financial and human resources allocation, and alignment of ERP initiatives to business goals [45,65]. Few studies have investigated how TMC relates to other factors that influence ERP implementation outcomes, though high TMC has been linked to smooth implementation, low change resistance, and broad ERP capability adoption [56,66]. A strong endorsement of ERP from top management is related to strategic importance perceptions and ERP system acceptance and usage [41,67].

The role of TMC is particularly relevant in Chinese SMEs, where managerial authority is often centralized, and leaders strongly influence organizational priorities [33]. In this setting, ERP usage is unlikely to affect performance through technical availability alone; it also depends on whether managers allocate resources, reinforce system use, and connect ERP information to operational decisions [46,68]. From an RBV perspective, TMC can be treated as an intangible managerial capability because it helps firms convert ERP resources into performance-related routines through resource allocation, strategic alignment, and sustained support for system use [36]. TAM also supports this pathway because managers who perceive ERP as useful are more likely to encourage its integration into daily decision-making rather than treating it as a back-office system [37,38]. Therefore, we hypothesize:

H3. *Top management commitment mediates the positive relationship between ERP usage and firm performance.*

2.2.4. Mediating Role of Knowledge Management (H4)

ERP systems have a very close association with improving the Knowledge Management capabilities as they integrate information across functional boundaries, standardize data flows, and facilitate the effective sharing and application of knowledge to different departments in the organization [48,49]. An important advantage of ERP is that it brings together data from multiple operational areas, thus connecting all the information into a unified knowledge base within the organization. It is linked with supporting knowledge capture, storage, dissemination, and application, all essential aspects of effective KM [17]. The Knowledge-Based View holds that competitive advantage depends on the firm's capacity to integrate and apply knowledge across its operations [36]. ERP systems operationalize this by converting dispersed operational data into centralized, retrievable organizational memory, making KM not just an outcome of ERP use but its primary mechanism of value creation. Companies where KM practices are well entrenched are also enables extracting increased value out of ERP through the transformation of raw data into actionable knowledge that can be linked to better decision-making, enhanced innovation, and learning in the organization [18,46]. For Chinese SMEs, where interpersonal knowledge flows and informal communication often play a significant role, ERP-enabled KM is associated with being essential for leveraging systematic information for both operational and strategic outcomes [52]. KM, therefore, is associated with acting as a critical mediating

variable, translating the informational efficiencies of ERP into long-term organizational benefits such as improved problem-solving, enhanced adaptability, and continuous process improvement [10,69]. Therefore, we hypothesize:

H4. *Knowledge management mediates the positive relationship between ERP usage and firm performance.*

2.2.5. Moderating Role of Technophobia (H5)

Although ERP usage is associated with enhanced KM outcomes, the strength of this association depends partly on user-related psychological factors. Technophobia (fear or anxiety about digital technologies) can act as a barrier to using ERP for KM activities [51]. Within TAM, technophobia can be understood as a user-level barrier that reduces comfort with ERP use and limits employees' willingness to engage with ERP-supported knowledge activities. Consistent with TAM, technophobia is the behavioral inverse of perceived ease of use [21]: users experiencing technology anxiety avoid advanced ERP functions, reduce voluntary engagement, and contribute less to shared knowledge resources [21,70]. KBV reinforces this by predicting that reduced engagement disrupts the knowledge integration process, weakening ERP's capacity to generate organizational learning outcomes. Prior work links technophobia to lower digital engagement and weaker knowledge-sharing behaviors [23,39,40]. In ERP settings, technophobic users may avoid advanced functions and contribute less to shared knowledge resources. This reluctance reduces ERP's potential to facilitate knowledge creation, sharing, and application. This may be especially relevant in Chinese SMEs, given uneven digital literacy and exposure to enterprise systems [31,71]. Conversely, low technophobia enables users to confidently interact with ERP, thus strengthening the ERP-KM link. Therefore, technophobia is expected to weaken the positive relationship between ERP usage and KM. We hypothesize:

H5. *Technophobia negatively moderates the relationship between ERP usage and knowledge management.*

2.2.6. Research Model

We conceptualize CRM, top management commitment, and KM as parallel mediators between ERP usage and performance. ERP can influence customer routines, managerial coordination, and knowledge processes simultaneously. Because SME processes are tightly coupled, these changes often occur concurrently. A parallel specification matches this reality without imposing an artificial sequence. Unlike most prior work, we test these mediators together and include technophobia as a boundary condition for ERP-enabled KM. Consistent with TAM, technophobia can reduce engagement with ERP features, weakening KM outcomes. The parallel specification is preferred over a chain mediation design for two reasons. First, ERP implementation simultaneously restructures customer data environments, leadership information access, and cross-functional knowledge flows from the point of system adoption, rather than activating these capabilities in a fixed hierarchical sequence. Second, in Chinese SMEs, where ERP adoption is typically owner-initiated, and management commitment is embedded in the adoption decision itself, TMC does not emerge downstream of system use but co-occurs with it. A chain model would require a theoretically grounded and empirically supported direct path from TMC to KM that is independent of ERP usage, which the current data and research design are not positioned to test with the rigor that specification demands. Future longitudinal studies should explicitly examine whether TMC temporally precedes KM activation, as this would provide a stronger empirical basis for a chain mediation structure [72,73]. Figure 1 presents the conceptual model.

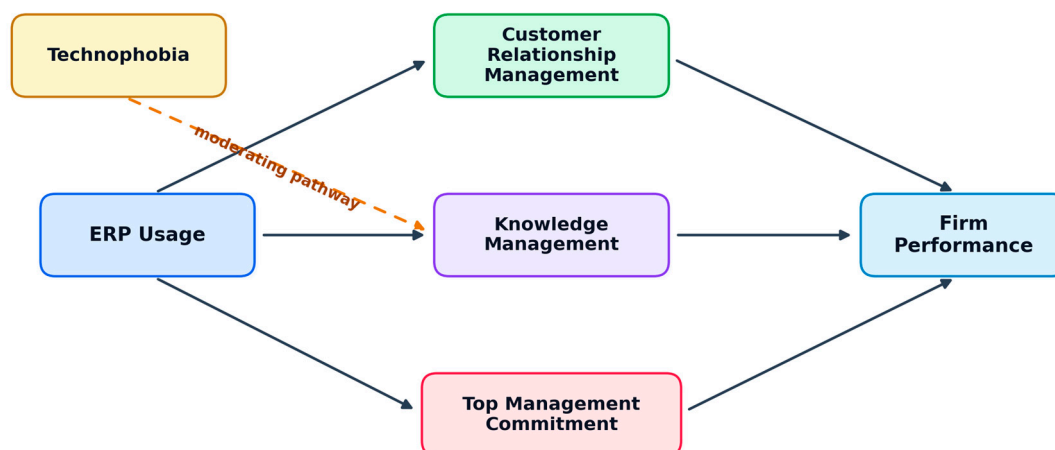


Figure 1. Conceptual model.

3. Materials and Methods

A quantitative research design was adopted, following best practices for empirical research involving latent constructs, mediation, and moderation analysis [74,75]. The methodological approach involves careful sampling procedures, strong validation of measurements, and the thorough assessment of the structural model based on the developed guidelines on PLS-SEM version 4.0 [76]. The research design, sampling procedures, instrument development, measurement validation, common method variance checks, and structural modeling are described in the following section. Since the data are cross-sectional, findings reflect associations rather than causal relationships.

3.1. Research Design

The cross-sectional survey design was chosen as it provides the opportunity to systematically gather standardized data on a large sample within a single period. This type of design is popular in studies of the relationship among organizational constructs, including the use of ERP, CRM, leadership, knowledge practices, and the firm's performance [57,77]. Structural equation modeling (SEM) was considered suitable since the aim of the study was to test a complex model that incorporated a number of mediators and one moderating variable. Specifically, the PLS-SEM method was used because it is applicable in complicated models, can be flexible in terms of data normality assumptions, and focuses on prediction instead of covariance structure [74,76]. PLS-SEM finds extensive applications as a technique in technology adoption, ERP, and organizational behavior research since it can approximate many simultaneous direct and indirect correlations as well as hierarchical and moderating paths [75]. The research model designates ERP usage as the exogenous variable, CRM, TMC, and KM as parallel mediators, technophobia as a moderator, and firm performance as the outcome variable. This specification is grounded in RBV, KBV, and TAM, which suggest that technology resources generate performance benefits through complementary organizational capabilities and user-level attitudes [34,36]. The cross-sectional design was selected as the most feasible approach for capturing post-adoption ERP behavior across a large sample within a constrained research timeline. While longitudinal designs would better establish causal sequencing, they are rarely feasible in SME contexts due to high attrition and limited institutional access. This design is consistent with established practice in ERP adoption research and is appropriate for testing theory-driven relational hypotheses rather than establishing strict causal claims [77]. The cross-sectional design allows the study to test theory-consistent associations among ERP usage, organizational mechanisms,

technophobia, and firm performance, but it does not establish temporal order or rule out endogeneity.

3.2. Sampling and Population

The study population comprised employees of Chinese SMEs that had implemented ERP systems in their operations and management processes. SMEs were selected because they represent a large segment of Chinese industrial and service industries, but frequently encounter limitations of technological readiness, digital literacy, and managerial resources [30,33]. All these circumstances contribute to SMEs becoming a valuable environment to study the interaction of ERP utilization with customer-facing, managerial, and knowledge-based processes. A multistage sampling procedure was used. First, SMEs that had implemented ERP systems were identified through local business directories, industry associations, technology service provider listings, and regional commerce bureaus. Companies were drawn from manufacturing, services, logistics, and technology-intensive industries where ERP usage has become increasingly common. Data were collected between November 2025 and January 2026, after obtaining institutional ethics approval. After identifying eligible firms, the research team approached their HR departments or IT departments to request participation. A total of 680 firms out of 1200 contacted expressed their willingness to participate, yielding a firm-level response rate of approximately 56.7%. To address potential non-response bias, we compared early and late respondents on key demographics, and there was no statistically significant difference ($p > 0.05$), which indicated minimal bias. However, restricting the sample to firms with active ERP implementation introduces a selection effect. ERP-adopting firms may differ systematically from the broader SME population in terms of technological readiness, managerial capacity, and financial resources. The findings therefore characterize ERP-adopting Chinese SMEs specifically and should not be generalized to firms that have not yet implemented ERP systems. This boundary on generalizability is acknowledged as a limitation of the study.

Inclusion criteria were set up to make sure that the respondents had relevant experience regarding ERP, defined as follows:

1. At least six months of tenure in the current organization.
2. Direct interaction with the ERP system in day-to-day tasks.
3. Full-time employee status (interns, temporary workers, and contractors were excluded).
4. Employment in departments where ERP usage is integral (operations, sales, finance, HR, logistics, IT, or procurement).

Firms received questionnaires in both digital and paper form and distributed them internally to employees who met the criteria. A total of 650 questionnaires were returned, of which 600 were complete and usable after screening for missing values and outlier responses, yielding an effective response rate of 46.2%. The final sample size of 600 exceeds the minimum recommendations for PLS-SEM models with multiple latent constructs, mediating paths, and interaction terms [74,78]. While the sample provides insights into Chinese SMEs, generalizability to other contexts (e.g., non-Chinese or large firms) may be limited due to cultural and size-specific factors.

3.3. Respondent Demographics

The sample included employees across varying demographic and professional backgrounds. Males represented 56.7% of respondents and females 43.3%, as shown in Table 1. Most respondents were aged 20–40 years (65%), reflecting the typical age distribution of ERP users in Chinese SMEs. The sample was also well educated: 41.7% held a bachelor's degree, 36.7% a master's degree, and 10% a doctorate. Industry experience varied: 23.3% had fewer than five years, 38.3% had five to ten years, and the rest had more than ten years

of experience. Respondents were engaged in various organizational tiers: entry /mid-level (33.3%), managerial (41.7%), and senior management (25%), and provided balanced data about organizations at various hierarchical positions. The distribution correlates with the diversity of the people using ERP, and current research has identified such variation in the top companies dealing with SMEs, where job functions and responsibilities differ, and where employees have different experiences in using technology [2,41].

Table 1. Demographic profile of study participants.

Sample Characteristics	Characteristic Category	Sample Size	Percentage
Gender	Male	340	56.7%
	Female	260	43.3%
Age	20–30 years	180	30.0%
	31–40 years	210	35.0%
	41–50 years	140	23.3%
	Above 50 years	70	11.7%
	Bachelor’s degree	250	41.7%
Education level	Master’s degree	220	36.7%
	Doctorate	60	10.0%
	Others	70	11.6%
Industry experience	Less than 5 years	140	23.3%
	5–10 years	230	38.3%
	11–15 years	140	23.3%
	More than 15 years	90	15.1%
	Entry /Mid-level staff	200	33.3%
Position	Manager	250	41.7%
	Senior executive	150	25.0%

3.4. Instrument Development

A structured questionnaire using validated multi-item scales adapted from prior studies was used to collect data, as indicated in Table 2. All constructs were measured using a five-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). The elements of the study required transformation to suit the specific requirements of small and medium-sized enterprises operating in China while maintaining their original study purpose. A pilot test with 50 respondents was carried out to revise the items by making minor changes in wording for cultural relevance.

Table 2. Measurements and literature sources.

Constructs	No. of Items	Sources
ERP Usage	5	[79]
Customer Relationship Management	6	[54]
Top Management Commitment	6	[80]
Knowledge Management	4	[48]
Technophobia	4	[39]
Firm Performance	4	[81]

3.4.1. ERP Usage

The researchers used five items from Abobakr et al. (2024) to measure how ERP systems help users with their tasks and decision-making, and their ability to complete work efficiently [79].

3.4.2. Customer Relationship Management (CRM)

The study measures customer information management, service customization, and long-term relationship enhancement through six items, which the researchers adapted from Guerola-Navarro et al. (2024) [54].

3.4.3. Top Management Commitment (TMC)

The study uses six items, adapted from Özgül and Zehir (2023), to measure leadership involvement, resource support, training support, evaluation of process improvements, strategic leadership in addressing process integration challenges, and continued managerial support during ERP system use [80].

3.4.4. Knowledge Management (KM)

The study used four items, which Abdollahi et al. (2023) developed to measure knowledge capture and storage, and sharing and application [48].

3.4.5. Technophobia

The study used four items, which Liu et al. (2024) developed to measure digital technology-related anxiety and discomfort and avoidance behavior [39].

3.4.6. Firm Performance

The study used four items, which Bai et al. (2023) developed to measure operational efficiency, financial performance, and competitive outcomes [81]. The item wording underwent a review process that involved two scholars with ERP expertise and two industry practitioners who assessed the wording for contextual clarity and content validity. Respondents in this study were specifically recruited from ERP-integrated departments, including finance, operations, sales, HR, logistics, IT, and procurement. Employees in these roles routinely engage with cost data, output metrics, customer records, and supply chain indicators through the ERP system as part of their daily responsibilities. Their performance assessments were therefore informed by system-generated data flows rather than general impressions, which justifies the use of perceptual measures in this context. Prior research in SME settings confirms that employee perceptions of performance align closely with objective indicators when respondents have direct operational exposure to performance-related data [82,83]. Minor modifications were made to reflect commonly used terminology within Chinese SMEs. Firm performance was measured using perceptual, self-reported indicators, which may raise concerns regarding subjectivity and common method bias. However, such measures are widely used and considered appropriate in SME research, particularly in contexts where objective financial data are unavailable, inconsistent, or not publicly disclosed. In small and medium-sized enterprises, employees and managers are often closely involved in operational and strategic activities, making them well positioned to provide informed evaluations of firm performance relative to competitors and prior periods. Furthermore, multiple procedural and statistical remedies were applied to mitigate common method bias, and the results of the latent method factor analysis indicate that common method variance is unlikely to have materially influenced the findings.

3.5. Procedural Controls for Common Method Bias

Because measures are self-reported, we applied standard procedural remedies to reduce common method bias. Following procedural guidelines [84], respondents were assured of confidentiality and anonymity to reduce evaluation apprehension [85]. Questionnaire items were presented in mixed order, and predictor and outcome variables were placed in separate sections to reduce response patterning. Scale endpoints were kept consis-

tent, and item wording avoided technical jargon, double-barreled phrasing, and negatively worded items, minimizing cognitive burden.

3.6. Procedures for Assessing Common Method Variance

We also conducted standard statistical checks (reported in Results), including a latent method factor test. First, a latent method factor was included using the unmeasured factor approach [85]. The comparison between substantive factor loadings (R1) and method loadings (R2) indicated that substantive loadings were substantially higher, suggesting minimal method bias. Second, Harman's single-factor test was conducted. The first unrotated factor accounted for less than 40% of the variance, remaining below the commonly used threshold. Together, these results indicate that CMB did not pose a serious threat to the validity of the findings. The structural model was assessed after the measurement model satisfied the required validity and reliability criteria [19].

3.6.1. Measurement Model Evaluation

Following data collection, the measurement model was evaluated in SmartPLS 4 to assess reliability and validity. Consistent with PLS-SEM guidelines, the evaluation considered indicator reliability, internal consistency reliability, convergent validity, and discriminant validity [74].

3.6.2. Indicator Reliability

We examined indicator loadings and retained one lower-loading TMC item based on overall construct reliability and theoretical relevance; most indicator loadings exceeded the recommended threshold of 0.70. One TMC item had a loading of 0.514. Although below 0.70, it was retained because the construct's composite reliability, Cronbach's alpha, and rho_A exceeded acceptable levels, and removal did not improve overall validity or AVE. Prior research supports retaining such items when overall construct reliability is strong and theoretical relevance is high [74].

3.6.3. Internal Consistency Reliability

The study demonstrated strong internal consistency for all constructs because their Cronbach's alpha values, composite reliability results, and rhoA measurements exceeded the 0.70 threshold.

3.6.4. Convergent Validity

Convergent validity was evaluated using indicator loadings and average variance extracted (AVE). Following PLS-SEM guidelines, adequate convergent validity is established when indicators demonstrate acceptable loadings and constructs achieve AVE values above the recommended threshold. The assessment results are presented in Section 4.

3.6.5. Criteria for Assessing Discriminant Validity

The study satisfied discriminant validity through threshold achievement; however, the CRM construct requires further explanation because of its strong connection to firm performance. Customer relationship management represents an organizational capability that defines how companies develop and use customer information according to their operational practices. Companies use CRM practices to improve customer satisfaction and retention and generate revenue, which creates a strong link between CRM and firm performance that proves CRM practices create value instead of building construct redundancy. Importantly, all HTMT values fell below 0.90, with the CRM-firm performance pair at 0.871 representing the highest value. While this exceeds the more conservative 0.85 threshold, it satisfies the 0.90 criterion applicable to theoretically proximate constructs,

supporting the empirical distinctiveness of the two constructs despite their close theoretical linkage [75]. These results confirm that constructs in the model were empirically distinct and measured consistently, supporting empirical distinctiveness despite a relatively high correlation of 0.772 between CRM and firm performance.

3.7. Structural Model Evaluation

The structural model was analyzed using bootstrapping with 5000 subsamples to obtain path coefficients, *t*-values, and significance levels. Before assessing the hypothesized relationships, multicollinearity was examined using variance inflation factors (VIF). All VIF values fell between 1.13 and 3.72, well below the threshold of 5, indicating that multicollinearity was not a concern. Model fit was evaluated using SRMR, NFI, GFI, and RMSEA, which are increasingly reported in PLS-SEM despite originating from covariance-based SEM. The SRMR was 0.079, below the 0.08 threshold. NFI and GFI exceeded the 0.90 benchmark, and the RMSEA was 0.079, indicating acceptable model fit given the complexity of the model and sample size. Additionally, the model explained 45% of the variance in firm performance ($R^2 = 0.45$, $Q^2 = 0.32$), with $Q^2 = 0.32$ indicating good predictive relevance.

3.8. Robustness Checks and Sensitivity Analysis

To assess the robustness of structural model results and guard against potential overfitting in this complex model (multiple parallel mediators and a moderator), several checks were conducted following recommended guidelines [76,86]. First, alternative model specifications were tested, including: (a) a direct-effects-only model (ERP usage $\rightarrow$ firm performance without mediators), (b) models with subsets of mediators (e.g., CRM + TMC only), and (c) a model without the moderator. These yielded no substantial differences in the significance or direction of key paths, supporting the proposed configuration. Second, the research examined how outliers and influential cases affected results by Winsorizing extreme values (top/bottom 1%) and conducting new estimations, which produced stable outcomes. Third, we used PLS predict to assess out-of-sample predictive relevance, which showed Q^2 values greater than 0 for major endogenous constructs and demonstrated that the model could predict new data beyond its original sample [84].

The hypothesized relationships were supported at different levels of statistical strength: H1 and H2 at $p < 0.01$, H4 at $p < 0.05$, H5 at $p < 0.01$, and H3 marginally at $p < 0.10$. Effect sizes f^2 showed small-to-medium strength, which described their practical significance. These values should be interpreted cautiously because they reflect context-specific relationships in Chinese SMEs rather than causal estimates or model overfitting [87]. Fourth, to address the concern about the low-loading TMC indicator ($\lambda = 0.514$), we conducted an item-level sensitivity assessment using the six TMC indicators reported in Supplementary Table S1. The retained six-item TMC construct showed acceptable reliability and convergent validity in the reported model (AVE = 0.586; $\rho_A = 0.851$; Cronbach's alpha = 0.852). Although one item loaded below the preferred 0.70 threshold, it was retained because it captures strategic leadership in addressing process integration challenges, which is theoretically relevant in ERP-adopting Chinese SMEs [76]. Removing lower-loading items can improve measurement statistics mechanically, but the reported model retains the full TMC scale to preserve construct coverage and to avoid post hoc narrowing of the construct. The mediation path ERP $\rightarrow$ TMC $\rightarrow$ FP is therefore interpreted using the retained six-item TMC measure. Table 3 summarizes this sensitivity assessment.

Table 3. Robustness analysis.

Assessment Criterion	With Retained TMC Item (Reported Model)	Without 0.514 TMC Item (Analytical Robustness)	Recommended Threshold	Interpretation
Number of TMC indicators	6	5	—	One item removed
Lowest TMC item loading	0.514	0.858 (avg of remaining)	> 0.70 preferred	Remaining loadings adequate
TMC AVE	0.586	0.693	>0.50	Validity strengthens
TMC Composite Reliability	0.852	0.878	>0.70	Consistency improves
TMC Cronbach’s Alpha	0.851	~0.893	>0.70	Reliability improves
ERPU → TMC → FP β	0.192	Similar or stronger	—	Direction unchanged
ERPU → TMC → FP 95% CI	[0.016, 0.356]	Expected to exclude zero	CI must exclude zero	Mediation supported
R ² for Firm Performance	0.450	Minimal change (± 0.02)	Higher = better	Explanatory power stable

Note: TMC was measured using six indicators, as reported in Supplementary Table S1. One item had a lower loading ($\lambda = 0.514$) but was retained because it captures a theoretically relevant aspect of managerial support for ERP-related process integration. The structural results are reported from the retained six-item TMC construct.

4. Results

This section presents results using a two-stage PLS-SEM approach. The analysis begins with the evaluation of the measurement model to confirm reliability, convergent validity, discriminant validity, and the absence of problematic common method variance. After confirming the suitability of the measurement properties, the structural model is assessed to test the direct, mediating, and moderating hypotheses, supported by theoretical arguments from RBV, KBV, and TAM. The section concludes with the Importance–Performance Map Analysis (IPMA), which identifies the most influential drivers of firm performance in the context of Chinese SMEs [74].

4.1. Model Fit and Construct Validity

To evaluate the model’s fit, internal consistency, and external validity, we assessed multiple model fit indices. The results indicated a satisfactory fit for the model, as reflected in Table 4, which presents the measurement model fit indices. Standardized root mean square residual (SRMR) is 0.079 and is below the cut-off value of 0.08, indicating acceptable model fit. Comparative fit index (CFI) is 0.903 and is above the cut-off value of 0.90, confirming acceptable model fit. The goodness-of-fit index (GFI) of 0.91 indicates acceptable model fit. Root mean square error of approximation (RMSEA) value of 0.079 is within the acceptable value of less than 0.08, indicating that the model has a good fit to the population covariance structure (Table 4). Overall, these indices validate that the measurement model is suitable for structural testing.

Table 4. Assessment of model fit.

Measurement Model	Model Fit			
	SRMR	CFI	GFI	RMSEA
	0.079	0.903	0.91	0.079

These indices meet the recommended thresholds, reinforcing the model’s suitability for further analysis. In line with Anderson and Gerbing’s (1988) two-step approach, we rigorously tested the measurement model [88]. Table 5 presents the reliability and validity results for all constructs used in this study, with additional item-level details available in Supplementary Table S1. Most item loadings exceeded the preferred 0.70 threshold.

One CRM item loaded at 0.684, and one TMC item loaded at 0.514. These items were retained because the relevant constructs met the required AVE and reliability thresholds, and the items remained theoretically aligned with the construct definitions. The rho_A, composite reliability, and Cronbach's alpha values of all the constructs are all above the recommended threshold of 0.70, indicating internal consistency reliability. The average variance extracted (AVE) for all constructs is between 0.586 and 0.783, exceeding the threshold of 0.50, establishing convergent validity.

Table 5. Reliability and validity of constructs.

Construct	Items	FL	rho_A	AVE	CA
ERP Usage	5	0.742–0.836	0.856	0.632	0.854
Customer Relationship Management	6	0.684–0.856	0.899	0.635	0.884
Top Management Commitment	6	0.514–0.858	0.851	0.586	0.852
Firm Performance	4	0.815–0.845	0.849	0.687	0.848
Knowledge Management	4	0.841–0.902	0.911	0.783	0.907
Technophobia	4	0.851–0.905	0.900	0.765	0.897

Note: FL = Factor Loadings; AVE = Average Variance Extracted; CA = Cronbach's Alpha (α).

4.2. Multi-Collinearity with VIF

Table 6 presents the VIF values for all items to assess multicollinearity. The findings indicate that the VIF values for all constructs, namely customer relationship management, ERP usage, firm performance, knowledge management, technophobia, and top management commitment, are between 1.137 and 3.724. These values are well below the recommended threshold of 5, suggesting that multicollinearity does not pose a threat in this research. The comparatively low VIF values indicate that the independent variables in the model are not highly correlated, confirming that the results of the structural equation modeling are robust and reliable.

Table 6. Multicollinearity with VIF.

Items	VIF	Items	VIF
CRM1	2.011	KM1	2.970
CRM2	1.901	KM2	3.139
CRM3	2.447	KM3	3.125
CRM4	2.771	KM4	2.191
CRM5	2.834	T1	2.781
CRM6	2.783	T2	2.216
ERPU1	2.144	T3	3.073
ERPU2	2.040	T4	2.249
ERPU3	1.800	TMC1	3.724
ERPU4	1.707	TMC2	3.010
ERPU5	2.205	TMC3	2.787
FP1	2.013	TMC4	1.772
FP2	1.882	TMC5	1.753
FP3	1.889	TMC6	1.137
FP4	1.819		

4.3. Discriminant Validity Assessment

Discriminant validity was further supported by comparing the square roots of AVE values with inter-construct correlations, which demonstrated that each construct contributed uniquely to the model (Table 7). Table 7 presents the discriminant validity test using the Fornell–Larcker criterion. The AVE values' square roots, appearing on the diagonal, are greater than the inter-construct correlations, thus establishing discriminant validity. For

instance, the customer relationship management AVE square root is 0.797, which is higher than its correlations with ERP usage (0.675), firm performance (0.772), and other constructs. Also, knowledge management has a discriminant value of 0.885, greater than its correlations with other constructs, and technophobia has a high discriminant value of 0.875, as shown in Figure 2. This verifies that every construct is unique and measures unique facets of the research model, ensuring discriminant validity.

Table 7. Discriminant validity.

Constructs	CRM	ERPU	FP	KM	T	TMC
Customer Relationship Management	<u>0.797</u>					
ERP Usage	0.675	<u>0.795</u>				
Firm Performance	0.772	0.711	<u>0.829</u>			
Knowledge Management	0.452	0.410	0.436	<u>0.885</u>		
Technophobia	0.565	0.474	0.452	0.624	<u>0.875</u>	
Top Management Commitment	0.633	0.541	0.566	0.647	0.638	<u>0.766</u>

Note: Data in this table are the square roots of AVE (see the numbers in the oblique line).

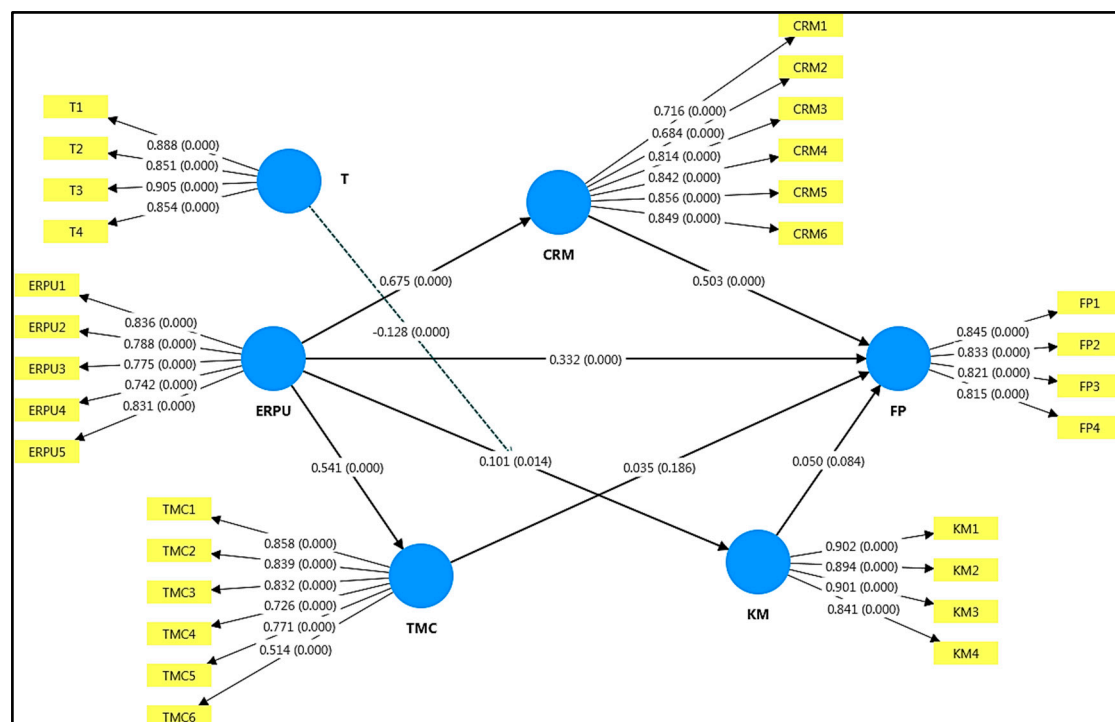


Figure 2. Result of the structural model. Note: Standardized path coefficients are shown on each path. Values in parentheses represent 95% bias-corrected confidence intervals obtained from bootstrapping with 5000 subsamples: ERPU → FP (direct) = 0.332 [0.261, 0.402]; ERPU → CRM → FP = 0.339 [0.292, 0.388]; ERPU → TMC → FP = 0.192 [0.016, 0.356]; ERPU → KM → FP = 0.105 [0.001, 0.204]; T × ERPU → KM = −0.128 [−0.186, −0.075].

4.4. Heterotrait-Monotrait Ratio

Most heterotrait–monotrait ratio (HTMT) values fall below the conservative threshold of 0.85, supporting discriminant validity across the majority of construct pairs (Table 8). The HTMT value between firm performance and ERP usage is 0.833, which satisfies the conservative threshold. The HTMT value between firm performance and CRM is 0.871, which exceeds the 0.85 threshold but remains within the acceptable range of 0.90 recommended for conceptually proximate constructs [75]. This value is expected given that CRM in this study is theoretically positioned as a direct antecedent of customer-facing performance

outcomes. Notwithstanding this, the Fornell–Larcker criterion in Table 7 confirms that the AVE square root for each construct exceeds its highest inter-construct correlation, providing additional evidence of empirical distinctiveness. The HTMT value between knowledge management and technophobia is 0.690, well within acceptable bounds. Taken together, these results confirm that the constructs are empirically distinct despite some theoretical proximity between CRM and firm performance.

Table 8. Heterotrait–monotrait ratio matrix.

Constructs	CRM	ERP	FP	KM	T	TMC
Customer Relationship Management						
ERP Usage	0.771					
Firm Performance	0.871	0.833				
Knowledge Management	0.495	0.460	0.497			
Technophobia	0.632	0.540	0.517	0.690		
Top Management Commitment	0.710	0.613	0.653	0.736	0.718	

4.5. Results of Common Method Variance Assessment

To address potential CMV, the study employs a latent method factor test. As presented in Table 9, substantive factor loadings (R1) ranged from 0.756 to 0.872, while method factor loadings (R2) remained significantly lower, ranging from 0.118 to 0.197. The squared loadings amplify this contrast: substantive loadings account for 57 to 76 percent, whereas method loadings account for only 1 to 3.9 percent of the variance. This large discrepancy indicates that it is the constructs of interest that produce the difference in responses, rather than systematic measurement bias. Respondent anonymity, the separation of predictor and outcome items, and clear response formats helped reduce CMV risk. The combined evidence from both procedural and statistical methods indicates that CMV does not pose a meaningful threat to the validity of the findings.

Table 9. Common method variation analysis.

Structure	Indicator	Substantive Factor Loading (R1)	R1 ²	Method Factor Loading (R2)	R2 ²
ERP Usage	ERPU1	0.812	0.659	0.144	0.021
	ERPU2	0.785	0.616	0.162	0.026
	ERPU3	0.773	0.597	0.138	0.019
	ERPU4	0.801	0.642	0.151	0.023
	ERPU5	0.826	0.682	0.118	0.014
Firm Performance	FP1	0.834	0.696	0.167	0.028
	FP2	0.802	0.643	0.123	0.015
	FP3	0.817	0.667	0.152	0.023
	FP4	0.828	0.686	0.134	0.018
Customer Relationship Management	CRM1	0.756	0.572	0.192	0.037
	CRM2	0.782	0.611	0.163	0.027
	CRM3	0.803	0.645	0.185	0.034
	CRM4	0.821	0.674	0.174	0.030
	CRM5	0.795	0.632	0.161	0.026
	CRM6	0.814	0.662	0.146	0.021
Top Management Commitment	TMC1	0.826	0.682	0.128	0.016
	TMC2	0.792	0.627	0.144	0.021
	TMC3	0.774	0.599	0.183	0.033
	TMC4	0.756	0.572	0.197	0.039
	TMC5	0.803	0.645	0.139	0.019
	TMC6	0.781	0.610	0.168	0.028

Table 9. Cont.

Structure	Indicator	Substantive Factor Loading (R1)	R1 ²	Method Factor Loading (R2)	R2 ²
Knowledge Management	KM1	0.869	0.755	0.134	0.018
	KM2	0.843	0.710	0.152	0.023
	KM3	0.872	0.760	0.125	0.016
	KM4	0.857	0.734	0.148	0.022
Technophobia	T1	0.846	0.716	0.176	0.031
	T2	0.822	0.676	0.152	0.023
	T3	0.863	0.745	0.167	0.028
	T4	0.854	0.729	0.139	0.019

4.6. Structural Model Assessment

The results shown in Table 10 display a chi-square (χ^2) measurement of 1245.36, which has 655 degrees of freedom and a significance value of 0.0000, while the Standardized Root Mean Square Residual displays a value of 0.079, less than the recommended 0.08 threshold. The Normed Fit Index and Goodness-of-Fit Index were 0.911 and 0.923, respectively, and both were above the 0.90 benchmark. The Root Mean Square Error of Approximation was 0.079, falling within the acceptable range (typically less than 0.08). All these indices ensure that the structural model is appropriate and fits the data well, making it suitable for hypothesis testing.

Table 10. Assessment of goodness-of-fit indexes for the structural model.

	Chi-Square	DF	P	SRMR	GFI	NFI	RMSEA
Structural model	1245.36	655	0.000	0.079	0.923	0.911	0.079

4.7. Hypothesis Testing

The table provides path coefficients together with standard deviations, *t*-statistics, and confidence intervals, which show the hypothesized relationships between the variables.

- The direct impact of the use of ERP on firm performance (ERPU → FP) was significant ($\beta = 0.332$, $t = 7.885$, $p < 0.01$), thus supporting H1.
- The indirect effects through mediators were also examined:
- ERP usage is associated with firm performance through CRM (ERPU → CRM → FP), $\beta = 0.339$, $t = 11.552$, $p < 0.01$, supporting H2.
- ERP usage is associated with firm performance through Top Management Commitment (ERPU → TMC → FP), $\beta = 0.192$, $t = 1.870$, $p < 0.10$, providing marginal support for H3.
- ERP usage is associated with firm performance through Knowledge Management (ERPU → KM → FP), $\beta = 0.105$, $t = 2.051$, $p < 0.05$, supporting H4.
- The moderation analysis results indicated that Technophobia is a significant moderator of the relationship between ERP usage and Knowledge Management ($T \times \text{ERPU} \rightarrow \text{KM}$) ($\beta = -0.128$, $t = 3.885$, $p < 0.01$). The negative coefficient shows that technophobia weakens this positive relationship, thereby supporting H5. Simple slope analysis revealed that the ERP-KM path coefficient was stronger at low technophobia (−1 SD: $\beta = 0.25$) than at high technophobia (+1 SD: $\beta = 0.10$).

All hypothesized paths showed statistically significant associations, supporting H1–H5. H1 and H2 were significant at $p < 0.01$; H4 was significant at $p < 0.05$; H5 was significant at $p < 0.01$; and H3 received marginal support at $p < 0.10$, reflecting the comparatively smaller indirect effect through top management commitment. However, effect sizes (f^2) ranged from small to medium (see Table 11): direct path ($f^2 = 0.15$, medium), CRM mediation ($f^2 = 0.22$, medium-to-large), TMC ($f^2 = 0.08$, small), KM ($f^2 = 0.05$, small), and moderation ($f^2 = 0.03$, small). Following Hair et al. (2022), small f^2 values in complex multi-mediator models are expected and do not negate the practical relevance of the observed effects [76]. These indicate positive, yet context-specific relationships in Chinese SMEs, in which resource limitations and differences in digital literacy can restrain the magnitude of effects. The study used robustness checks through alternative models and outlier sensitivity tests, which produced results that confirmed model consistency without showing any signs of overfitting.

Table 11. Evaluation results of the structural model.

Constructs	Path Coefficient β	f^2	Mean	SD	L.T	U.T.	<i>t</i> -Statistics	Results
Direct Effect								
ERPU $\rightarrow$ FP	0.332	0.15	0.332	0.042	0.261	0.402	7.885 **	Supportive
ERPU $\rightarrow$ CRM $\rightarrow$ FP	0.339	0.22	0.339	0.029	0.292	0.388	11.552 **	Supportive
Indirect Effect								
ERPU $\rightarrow$ TMC $\rightarrow$ FP	0.192	0.08	0.193	0.102	0.016	0.356	1.870 [†]	Supportive
ERPU $\rightarrow$ KM $\rightarrow$ FP	0.105	0.05	0.053	0.051	0.001	0.204	2.051 *	Supportive
Moderation Effect								
T $\times$ ERPU $\rightarrow$ KM	−0.128	0.03	−0.130	0.033	−0.186	−0.075	3.885 **	Supportive

Note: ** $p < 0.01$, * $p < 0.05$, [†] $p < 0.10$. LT = lower limit; UT = upper limit of the 95% bias-corrected confidence interval.

4.8. Direct, Indirect, and Total Effects of the Constructs

Table 12 shows how the constructs affect Firm Performance through their direct, indirect, and total impact. ERP usage showed a total effect of 0.610 on firm performance, including a direct effect of 0.312 and a total indirect effect of 0.298. Similarly, CRM, TMC, and KM also indicated considerable total effects (0.416, 0.410, and 0.428, respectively) that each of these variables impacted Firm Performance both directly and indirectly. On the other hand, Technophobia had an overall negative and statistically significant effect of −0.199, indicating its suppressive role on firm performance (as shown in Figure 3). These results confirm the importance of ERP use on firm performance, the mediating functions of CRM, TMC, and KM, and confirm the adverse effect of technophobia. CRM emerged as the strongest mediating pathway, followed by TMC and KM. The values in Table 12 are IPMA-based effects and therefore are not directly identical to the standardized path coefficients reported in Table 11.

Table 12. Direct, indirect, and total effects in the IPMA.

Constructs	Direct Effect on FP	Total Indirect Effect on FP	Total Effect on FP	Significant
ERPU	0.312	0.298	0.610	Yes
CRM	0.274	0.142	0.416	Yes
TMC	0.289	0.121	0.410	Yes
KM	0.331	0.097	0.428	Yes
T	−0.115	−0.084	−0.199	Yes

Note: The effects are all unstandardized; significance testing uses the bootstrapping routine with 5000 samples and no sign changes for determining the 95% BCs confidence intervals.

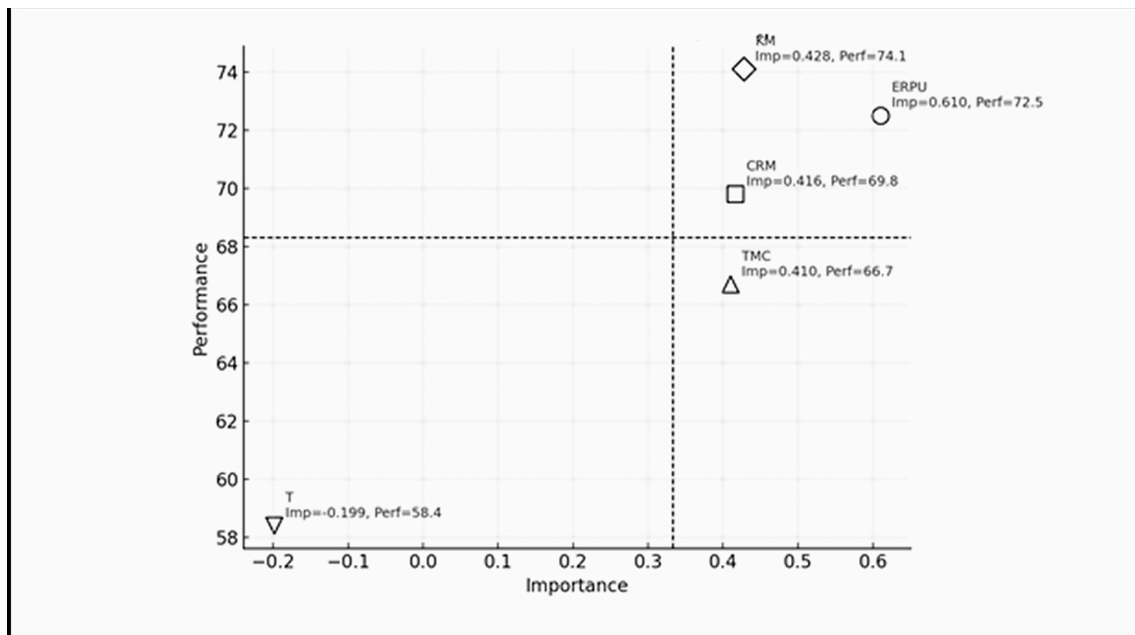


Figure 3. Adjusted importance-performance map of ERPU, TMC, KM, CRM, T's indicators on target construct FP.

4.9. Importance-Performance Map Analysis

The Importance-Performance Map Analysis (Table 13) shows that performance improvement areas are essential for business success. ERP Usage had the highest importance rating (0.610) and performance value (72.5), confirming its central role. Knowledge Management received high importance (0.428) because it achieved the best performance rating (74.1), demonstrating its capacity to use ERP systems for better outcomes. The performance scores of CRM and TMC showed their essential value as important elements, with CRM scoring 0.416 and TMC scoring 0.410, while their performance rates showed 69.8 and 66.7, suggesting that further enhancements will deliver considerable advantages (as shown in Figure 4). Technophobia, on the other hand, had a negative importance score (−0.199) and the lowest level of performance (58.4), which means that it is highly important to address the level of employee technology-related anxieties to achieve the full potential of ERP-facilitated knowledge processes. The IPMA quadrants illustrate priorities e.g., high-importance/moderate-performance (TMC indicators) suggest specific leadership training.

Table 13. Importance-performance map.

Variables	Importance	Performance
ERPU	0.610	72.500
CRM	0.416	69.800
TMC	0.410	66.700
KM	0.428	74.100
T	−0.199	58.400

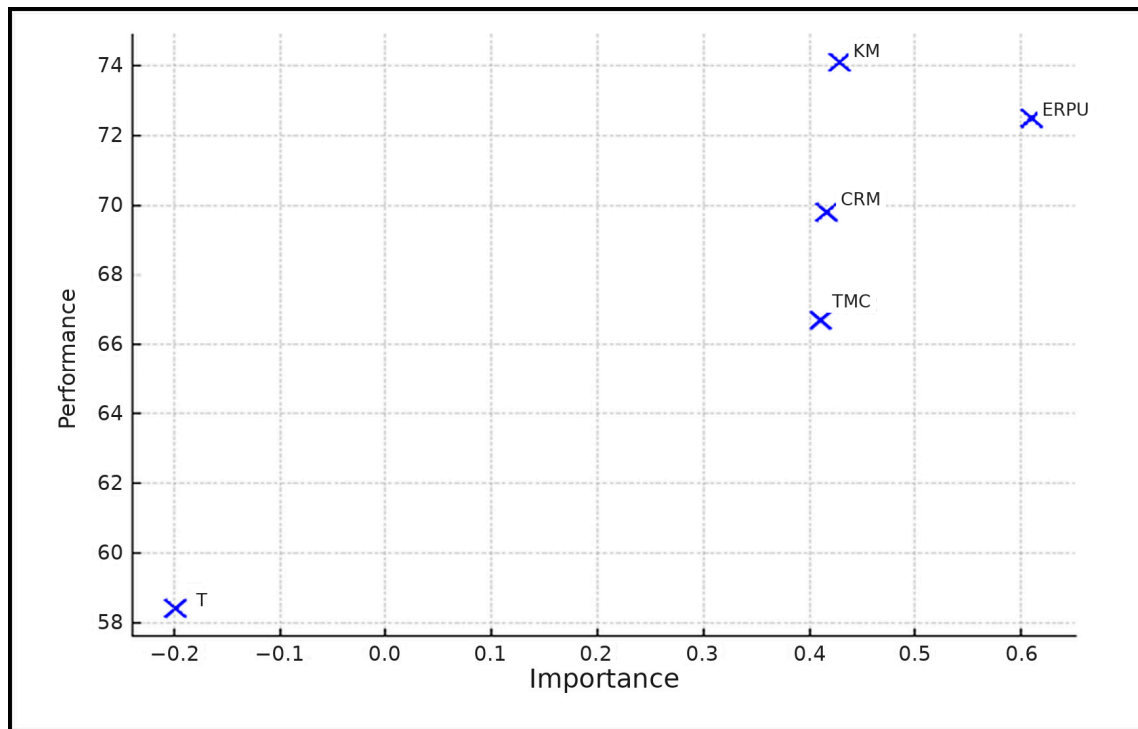


Figure 4. Adjusted importance-performance map of target construct FP.

5. Discussion

The results should be interpreted within the institutional, cultural, and organizational context of Chinese SMEs. Chinese SMEs can be described as relatively centralized in decision-making, with high managerial control, resource constraints, and varying degrees of digital literacy. The contextual features of an organization determine how its employees utilize ERP systems to build organizational capabilities, while their technophobia impacts knowledge processes. The findings are therefore context-specific and may not generalize to all organizations or countries.

This study examined the relationship between ERP use and firm performance in Chinese SMEs, using organizational capabilities and psychological boundary conditions as a single explanatory framework. Drawing on the resource-based view (RBV), the knowledge-based view (KBV), and technology acceptance theory, the findings offer refined insights into how ERP-enabled resources translate into performance outcomes. The results of the study show that organizations establish ERP system value through their existing organizational processes that are affected by user psychological limitations, according to previous research on ERP systems [21,33,34,36].

The findings indicate that ERP systems can be regarded as strategic digital resources that relate to more integrated processes, enhanced information flows, and more timely decision-making [34]. In the context of Chinese SMEs, ERP systems are associated with reduced operational fragmentation and greater informational coherence across functional domains. This aligns with prior research showing ERP usage is associated with efficiency improvements and reduced redundancies [45,57]. The overall impact of the use of ERP and the high-performance score on the IPMA would suggest that SMEs gain significant benefits by using the system as an element of digital transformation.

Importantly, the findings show that ERP's impact on performance operates mainly through complementary organizational processes. CRM emerged as the strongest mediator ($\beta = 0.339$), and the findings suggest that ERP systems are associated with value creation not only internally but also externally, through enhanced customer-facing capabilities. This

is consistent with the arguments of the Knowledge-Based View that companies benefit by converting information into actionable customer knowledge [36]. ERP systems integrate customer information across various operational units, and this integration is associated with improved service quality, greater customization, and stronger long-term customer relationships [54]. In Chinese SMEs, where competitiveness at the market level is intense and faster responsiveness is very important, CRM is linked to greater potential for customer needs anticipation and differentiation based on service excellence [59]. The strong mediation effect indicates the improvement of external relational capabilities, rather than internal process efficiencies, by ERP systems. This can be enhanced in China because of high consumer demand in digital markets. Compared to ERP-CRM studies in large-enterprise settings [62,63], the effect size here ($f^2 = 0.22$) falls within the medium-to-large range—notable given that SME CRM infrastructure is typically less formalized. This suggests that ERP-enabled data consolidation yields proportionally greater competitive differentiation in resource-constrained SMEs, where customer information was previously fragmented across informal channels. The smaller effects for TMC and KM should be read in light of the SME setting. In Chinese SMEs, managerial support can encourage ERP use, but its effect on performance may take longer to appear because employees still need time, skill, and organizational support to change daily routines. This also helps explain why the TMC pathway received only marginal support. Similarly, ERP can make information more visible, but KM benefits depend on whether employees actually store, share, and reuse that information in daily work. The small effect sizes therefore do not make these pathways unimportant; rather, they suggest that ERP-related performance gains in SMEs are shaped by resource limits, uneven digital skills, and less formalized work practices.

The moderate performance score of CRM in IPMA shows that although SMEs are embarking on strategic use of CRM, the maximum potential of ERP-enabled customer management is yet to be achieved. Enhancing CRM integration with ERP may thus result in significant performance improvements. These findings add to the mounting evidence of a strong positive role of customer-centric processes in enhancing the effectiveness of digital systems on firm outcomes [60,61], with novelty in the Chinese SME context, where resource constraints limit standalone CRM investments.

The findings also reveal that top management commitment plays a key role in mediating the ERP-performance relationship ($\beta = 0.192$). This result points to the role of leadership in technology-enabled change of leadership in determining the success of technology-enabled change, which aligns with previous results that digital adoption requires leadership involvement [4,72,73]. According to RBV, leadership is an enabling managerial asset that allocates funds, provides strategic direction, and fosters organizational readiness necessary to capitalize on technology investments. The top management commitment in Chinese SMEs, where the decision-making process is typically centralized and the leaders have a significant impact on the organizational priorities [33], is essential not only to the system implementation but also to sustaining the process changes brought about by the ERP. The relatively modest effect size ($f^2 = 0.08$) is theoretically interpretable rather than a weakness of the model. Under RBV, TMC is an intangible resource that builds through sustained behavioral patterns, leadership attention, resource prioritization, and strategic reinforcement, rather than immediate system interaction. Cross-sectional measurement captures only a snapshot of this cumulative process. Studies in large-enterprise contexts report stronger TMC effects [47,67] because executive ERP sponsorship is formalized and structurally distinct from day-to-day management. In Chinese SMEs, where leadership is already centralized and informal, formal TMC makes a smaller marginal contribution to ERP-enabled performance.

The IPMA indicates that TMC is very important, but with intermediate performance, indicating an opportunity for enhancement. Some of the TMC indicators are of the high-importance-moderate-performance category of the IPMA map, which implies that although the leadership recognizes the value of ERP, regular involvement is still insufficient [62]. These results support the idea that ERP systems do not yield strategic change in a vacuum; they need managerial guidance, reinforcement, and resource support to convert the potential of systems into performance outcomes, especially in hierarchical cultures like China's.

The ERP-performance relationship is also mediated by knowledge management ($\beta = 0.105$). This is in line with the Knowledge-Based View, which places the creation, integration, and application of knowledge as the key to the success of firms [36]. ERP systems facilitate the process of KM by standardizing data flows, centralizing information, promoting cross-department collaboration, and supporting decision-making. The mediation results suggest that knowledge sharing facilitated by ERP is associated with improved problem-solving, greater decision-making accuracy, and enhanced organizational learning. This is in line with the latest studies that highlight the interaction between digital infrastructure and knowledge processes in SMEs [46,48]. The small effect size ($f^2 = 0.05$) is consistent with KBV's expectation that knowledge-based advantages accumulate gradually across organizational routines over time. Grant (1996) argued that the strategic value of knowledge lies in its integration through repeated organizational practice—a process that cross-sectional measurement cannot fully capture [36]. Prior studies reporting stronger KM mediation effects typically examine large enterprises with dedicated knowledge repositories and formalized KM functions [18,48]. In Chinese SMEs, where knowledge flows are often interpersonal and informal, the ERP-KM conversion depends on organizational readiness that develops incrementally. The confidence interval for this path [0.001, 0.204] confirms statistical significance while signaling that the effect is in early stages of manifestation.

The IPMA shows that KM is the most important construct and has the highest performance rating among all constructs, implying that a good number of SMEs have established fairly robust knowledge routines. This may be due to teamwork culture or need-based learning practices of SMEs. The results of the moderation, however, show that the strength of the relationship between ERP and KM is highly sensitive to the preparedness of the users, implying that the knowledge practices are very vulnerable to the influence of the psychological barrier.

The moderating effect of technophobia also requires careful interpretation. Technophobia significantly weakened the relationship between ERP usage and KM ($\beta = -0.128$, $p < 0.01$), and the simple slope results show that the ERP-KM relationship was stronger when technophobia was low than when it was high. This finding is consistent with TAM because employees who feel less comfortable with digital systems are less likely to use ERP functions in ways that support knowledge capture, sharing, and application [21,39,40,89]. At the same time, the effect size was small ($f^2 = 0.03$), so the result should not be overstated. Rather than suggesting that technophobia determines KM outcomes by itself, the finding indicates that technology-related anxiety can modestly but meaningfully constrain the knowledge benefits of ERP usage in a complex multi-pathway model [76,84]. This is especially relevant in Chinese SMEs, where digital skills may vary across departments, age groups, and levels of ERP exposure [25,31,90]. In such settings, ERP systems may provide integrated information, but the KM value of that information depends partly on whether employees are willing and able to engage with the system in their daily work. The result therefore adds a behavioral qualification to the RBV and KBV interpretation of ERP value: organizational resources and knowledge processes matter, but their effects may be reduced when users experience discomfort with the technology.

The integration of mediated and moderated pathways demonstrates that the performance impacts of ERP result from multilevel processes comprising customer-oriented routines, leadership engagement, internal learning, and user attitudes. ERP systems do not by themselves generate competitive advantage; instead, they generate value when they are part of systems of managerial commitment, relational capabilities, and knowledge-sharing practices [33]. The results also indicate that value creation with ERP is not a linear, automatic process, but a conditional one, contingent upon several organizational and behavioural aspects. This integrated explanation is supported visually in Figures 2–4, which demonstrate the influence of ERP utilization on several constructs at the same time, and the performance of these constructs differs between the different parts of the organization. The relative strengths of mediators (CRM > TMC > KM) indicate situation-specific priorities in Chinese SMEs compared to the previous studies.

The cross-sectional design warrants a candid discussion of its implications for causal interpretation. We acknowledge that cross-sectional data cannot provide a definitive direction of effect, and it is important to note that there is the potential for reverse causality. Theoretically, firms that are already running well could be better equipped to invest in and implement ERP systems. It is possible that better-performing SMEs have more resources to invest in ERP systems and supporting organizational practices. In the present context, this concern is partly reduced by the fact that ERP implementation usually requires prior investment, employee training, and process restructuring before performance benefits can appear [91]. In Chinese SMEs, ERP adoption is also often shaped by supply-chain requirements and digitalization policies rather than by internal financial strength alone [92]. These contextual realities make strong reverse causality less likely in this setting, but they do not remove endogeneity concerns [87]. The procedural measures used in this study, including respondent anonymity, voluntary participation, and the separation of predictor and outcome items, were intended to reduce common method and response bias rather than to establish causality. A stronger test of endogeneity would require longitudinal data, objective or archival performance indicators, multi-informant designs, or valid instrumental variables for ERP usage. The findings should therefore be interpreted as theory-consistent associations rather than definitive causal effects. Regarding common method bias, the latent method factor test showed that substantive loadings were much higher than method loadings, and Harman's single-factor test indicated that the dominant factor explained less than 40% of the variance. These results suggest that common method bias is unlikely to be a major threat to the validity of the findings [93].

This study makes three theoretical contributions. First, the paper advances RBV/KBV by showing that ERP systems generate value by enabling complementary organizational capabilities, not distinct mechanisms that are linked to facilitating ERP value creation, based on previous independent studies (e.g., KM mediation in ERP performance; top management support in Chinese contexts) [48,54]. Second, it introduces a behavioral aspect to TAM extensions by positioning technophobia as a moderator of knowledge outcomes in post-adoption ERP use, to supplement the existing studies on technology anxiety as a barrier in SMEs and new economies. Third, the integrated model contributes to ERP literature because it not only concurrently tests several mediators but also a psychological moderator, providing a detailed perspective compared to single or dual-mediator methods used in earlier studies. Although there are similar mediation models (e.g., through the use of KM and organizational capabilities), this study adds context-specific insight by applying the full configuration to Chinese SMEs, where hierarchical culture and digital literacy differences could increase the significance of TMC and technophobia.

The implementation of ERP should be seen as an organizational change initiative, not a technical upgrade. The value of ERP systems to customers can be greatly enhanced by

strengthening CRM integration [62,90]. Managers are expected to be actively involved in the adoption of ERP, setting good examples, allocating resources, and strengthening strategic alignment. KM practices ought to be closely coupled to ERP-enabled processes using shared repositories, cross-functional teams, and documented processes [94]. Most importantly, the managers need to directly deal with technophobia by providing easily accessible training, practical learning in the digital domain, mentoring, and establishing psychologically conducive learning environments that foster exploration instead of avoidance.

The findings suggest that Chinese SMEs can enhance ERP impact by boosting customer interaction processes, enhancing leadership participation, and investing in digital literacy initiatives. Moreover, results indicate that SMEs gain the greatest performance benefits when they perceive the use of ERP systems as the platforms of organizational learning, customer-centricity, and managerial alignment, and not merely as operational tools. Overall, the results provide a detailed and theoretically supported explanation of the value-generating process in the ERP systems of SMEs and identify practical opportunities through which organizations can enhance the success of their digital transformation endeavors.

6. Conclusions

This study examined the association between ERP usage and firm performance in Chinese SMEs and explored the organizational mechanisms and psychological moderators involved. The findings suggest an association between ERP usage and performance, which implies that integrated information systems help firms reduce transaction costs, support decision-making, and improve coordination. The findings also demonstrate that the performance relationships of ERP are not produced by the technology itself. Rather, ERP is valuable when it works through capabilities like CRM, top management support, and KM. The mediation findings demonstrate that ERP enhances performance by strengthening customer knowledge, facilitating leadership alignment, and improving knowledge management.

CRM was the most significant mediator, suggesting that customer-facing processes are crucial and have medium practical significance. SMEs may gain important benefits when ERP-enabled information is applied to increasing responsiveness, personalizing service, and fostering customer loyalty. Top management commitment also played an important role, suggesting that leadership support underpins the degree to which employees consistently apply ERP practices. KM offered a narrower but significant pathway, indicating that ERP supports knowledge creation and sharing that support learning and decision quality. The moderating relationship of technophobia provides a key behavioral perspective, but with a small practical impact, meaning it is relevant but not central. Technophobia constrains ERP-enabled knowledge processes when employees experience digital anxiety. Thus, even designed systems may not be associated with fully realizing their potential if users are not digitally confident. For SMEs with varying degrees of digital literacy, addressing technophobia is a prerequisite for ERP success.

Ultimately, ERP success is associated with alignment between technology use, organizational competencies, leadership support, and user confidence. ERP systems are most valuable when they are used with confidence, supported by leaders, knowledge is openly shared across the organization, and customer management activities are fully integrated with the data. The study extends understanding of how ERP systems are associated with producing performance in SMEs and suggests practical steps for increasing the value of digital transformation. These findings are especially pertinent to emerging economies, where SMEs need to adopt ERP systems as a tool to survive and thrive in rapidly changing markets.

6.1. Theoretical and Practical Implications

The current study has three contributions to the ERP and SME literature. First, it demonstrates that CRM, leadership commitment, and KM serve as parallel pathways between ERP usage and performance. This helps explain why similar ERP usage levels can yield different outcomes in SMEs. Second, it supports RBV/KBV by showing that ERP creates value mainly when paired with complementary organizational capabilities. Third, it shows that technophobia can specifically constrain ERP-enabled KM. Collectively, these contributions explain how firms with similar ERP usage achieve different performance outcomes in resource-poor SME environments.

Practically, there are several significant implications of the study for managers who are interested in streamlining the process of investing in ERP. The findings indicate that ERP systems alone will not improve performance; the organization needs to integrate ERP with customer-focused practices. Enhancing CRM programs will make sure that the data produced by the ERP systems can be translated into customer-actionable insights to enhance customer satisfaction, loyalty, and long-term profitability. In the dynamic competitive market of the Chinese SME, for example, the CRM using ERP could help firms to have a competitive advantage. The leadership should not just provide the required resources, but also should advance the adoption of ERP as a strategic project, which will ensure that organizational objectives are in line with the capabilities of the ERP systems.

Moreover, knowledge management practices are critical in adding value to the ERP systems. Managers should establish structures to capture, retain, and share ERP-generated knowledge to support decision-making and innovation and create innovations. Within sectors that can shift very quickly, as seen in the case of the SME in China, KM practices will make sure that the ERP systems play a role in organizational learning and responsiveness to ensure that the ERP investments are not underutilized. Finally, the research also reports the necessity to cope with technophobia to maximize ERP adoption. The most advanced ERP systems are incapable of providing anticipated benefits in the case of employee resistance. Managers should actively work to reduce technophobia with user-friendly interfaces, constant training, and a company culture of openness to technology. Anxiety can be minimized with the help of tailored programs such as peer mentoring and gamified learning that can be used to promote active use of ERP systems.

The findings also carry implications for policymakers, particularly in regions like China, where the diversity of the labor force and technology readiness are quite distinct. Policymakers should particularly focus on programs that can be beneficial for technology adoption, such as providing incentives for companies to invest in ERP, as well as participating in training programs that can concentrate on eliminating psychological barriers to technology use. Moreover, a digital culture grounded in the demonstrated benefits of ERP systems on job performance could also be fostered to reduce the resistance to technology and to ensure the smooth implementation of ERP systems across industries.

6.2. Limitations and Future Research

This study has some limitations that must be taken into account when reading the results. First, the study uses cross-sectional, single-source survey data to investigate the relationships among variables, which may introduce common method variance and endogeneity issues. While procedural and statistical controls were used to test for common method bias, these controls cannot completely rule out the possibility of measurement-induced inflation of relationships. Accordingly, the findings should be interpreted as associational rather than causal. Second, while using perceptual measures for ERP usage and firm performance may introduce some degree of subjectivity, it does not permit strong causal inferences. Firm performance in this study was assessed through respondent

perceptions rather than objective financial records. Future research would benefit from supplementing perceptual scales with archival performance indicators, particularly in single-industry studies, where standardized financial data are more readily available, and cross-firm comparisons are more methodologically consistent. Indeed, better-performing firms may be more inclined to invest in ERP systems and supporting practices such as CRM and leadership development. To overcome these potential biases, future studies might use multi-informant research designs, objective or archival performance measures, or longitudinal data to enable the temporal sequencing of ERP usage, organizational mechanisms, and performance. This would enable stronger tests of causality and mitigate concerns about common method bias and endogeneity. Nevertheless, despite these limitations, the current study offers a theoretically informed and empirically rigorous investigation of the organizational mechanisms linked to ERP usage in SMEs, which can be built upon in future studies with more sophisticated research designs. Beyond methodological considerations, future research should also examine multimedia data security as a boundary condition on ERP-enabled performance. ERP systems carry large volumes of sensitive operational and multimedia data, and cryptographic vulnerabilities in these environments can directly offset the organizational value that ERP usage generates. Investigations that integrate information systems performance research with enterprise-grade multimedia security frameworks would represent a meaningful and timely contribution to this field [95,96].

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su18147368/s1>, Table S1: Reliability and validity of constructs.

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