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Inter-organizational Knowledge Sharing in the Digital Age: Unpacking the Roles of Knowledge Flow and Trust

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Abstract: The iterative development of digital technology has significantly transformed the ways and practices of inter-organizational knowledge sharing. This study aims to explore the mechanisms of inter-organizational knowledge sharing in the context of digitization. Specifically, it investigates the dynamic relationship between digital technology and inter-organizational knowledge sharing. Based on the knowledge-based view, this study adopts quantitative research methods, using 380 questionnaire data from industrial Internet enterprises, supply chain organizations and other strategic alliances engaging in business cooperation and collaborative innovation in China as samples, and adopts structural equation modeling (SEM) and multiple regression techniques to test the relationship among digital technology (DT), knowledge flow (KF), inter-organizational knowledge sharing (IKS) and inter-organizational trust (IOT). The results demonstrate a positive correlation between DT and IKS, KF plays a significant mediating role between DT and IKS, and the impact of KF on IKS is nonlinearly moderated by IOT. These findings offer guidance for managers to realize effective knowledge flow across organizational boundaries. They prompt organizations to proactively adopt cutting-edge digital technologies and processes. Organizations need to strengthen digital infrastructure, upgrade digital capabilities, nurture digitally-enabled culture, forge external partnerships and cultivate trust to sustain such knowledge exchange. This study focuses on the relationship between DT and IKS, and further explores the implementation mechanism of IKS. This study emphasizes the important role of KF and IOT, refining the research on IOT.

Keywords: Digital technology; Inter-organizational knowledge sharing; Knowledge flow; Inter-organizational trust; Nonlinear characteristics; Knowledge-based view.

1. Introduction

Digital technologies are profoundly transforming organizational management structures, driving the dynamic allocation and sharing of knowledge, and reshaping traditional modes of knowledge acquisition and information exchange [1]. By enabling multiple forms of knowledge representation, digitalization not only breaks down traditional organizational boundaries but also enhances inter-organizational knowledge flow, shifting knowledge-sharing from offline channels to online platforms. This transition facilitates rapid temporal and spatial interactions between individuals and organizations, thereby fostering mutual benefits [2]. For example, Airbus leverages its Skywise digital platform to facilitate supply chain knowledge-sharing with its global suppliers. In the production of the A320neo, Airbus used Skywise to share real-time design adjustment data with suppliers, enabling rapid recalibration of component production schedules and shortening the production cycle by approximately 10%. However, concerns among some suppliers about data security and potential trade secret leakage constrained the depth of data-sharing, underscoring the critical role of inter-organizational trust in digital knowledge-sharing. This case illustrates that while digital technology facilitates knowledge flow, variations in inter-organizational trust can affect the realized effectiveness of knowledge-sharing.

As the core element of knowledge-management, knowledge-sharing is the key to realize knowledge integration and enhance the value of organizational knowledge, involving the transfer and interaction of knowledge, experience and skills [3]. Inter-organizational communication is a prerequisite for acquiring valuable knowledge. Such exchanges strengthen the ongoing integration and interaction of Inter-organizational knowledge, fostering knowledge flow and creation. This helps bridge inter-organizational knowledge gaps, remedies shortfalls in organizational intellectual capital, and enables its collective acquisition and efficient utilization [4]. Digital technology exhibits substantial potential for facilitating inter-organizational knowledge sharing. For example, a variety of digital platforms and tools enable the codification, storage, dissemination, and access of knowledge, thereby holding promise for overcoming geographic and temporal constraints and enhancing inter-organizational collaboration [5]. However, systematic empirical research on how digital technology concretely affects the process of inter-organizational knowledge sharing remains limited. Consequently, we lack a clear understanding of the underlying pathways and mechanisms through which digital technology exerts their influence.

To deepen understanding of the underlying mechanisms of digital technology, it is essential to examine knowledge flow in digital contexts—that is, the dynamic transfer of knowledge across organizations via digital platforms and tools. Knowledge flow is not a simple transmission of information, but contains a complex dynamic process. Overlooking this critical digital flow situation may lead to a failure to fully understand how digital technology can be transformed into actual knowledge-sharing outcomes. Accordingly, investigating the mediating role of digital knowledge flow between digital technology and inter-organizational knowledge sharing is an urgent research priority.

Existing research also identifies inter-organizational trust as a critical situational factor affecting knowledge-sharing;

however, findings diverge on the direction and magnitude of its effects [6]. As a foundation for resource and information sharing, trust fosters cooperation among parties engaged in knowledge exchange and alleviates concerns about opportunism [7]. Yet most studies on trust and knowledge-sharing have been conducted in non-digital or low-digitization contexts. We know little about how varying levels of inter-organizational trust interact with digitally enabled knowledge flow, thereby moderating their impact on knowledge-sharing. Elucidating the moderating role of trust in digital contexts—particularly how it shapes the translation of digital knowledge flows into knowledge-sharing outcomes—is essential for building more explanatory theoretical models.

Accordingly, this study asks two research questions:

RQ1: How does digital technology facilitate inter-organizational knowledge sharing, and what mediating role does knowledge flow play?

RQ2: How do varying levels of inter-organizational trust moderate the relationship between knowledge flow and inter-organizational knowledge sharing?

Based on the knowledge-based view, this study advances an integrative perspective to examine how digital technology, knowledge flow, and inter-organizational trust jointly affect inter-organizational knowledge sharing. Unlike the existing research, this study makes two distinctive contributions. First, it provides a systematic empirical assessment of the effect of digital technology on inter-organizational knowledge sharing and, crucially, elucidates the specific mechanisms of knowledge flow. Rather than focusing solely on aggregate effects of digital technology, we analyze how digitally enabled knowledge flow concretely drive the knowledge-sharing process. Second, it empirically examines how inter-organizational trust moderates the relationship between digitally enabled knowledge flow and inter-organizational knowledge sharing in the context of digitalization. This helps to explain the reasons why trust affects the inconsistency of knowledge-sharing, and provides situational insights for understanding cooperation in the context of digital transformation.

2. Literature Review and Hypotheses Development

2.1. Literature Review

2.1.1. Knowledge-based View

The Knowledge-Based View (KBV) posits that knowledge-based resources, developed internally or at organizational boundaries, are difficult for competitors to imitate or replicate. These resources are considered key strategic assets that significantly influence an organization's long-term performance [8]. Meher and Mishra (2021) find that knowledge-sharing significantly improves employee performance through the mediating role of organizational learning, highlighting the importance of internal knowledge integration for organizational innovation [9]. However, organizations inevitably acquire external knowledge to augment their internal knowledge base, alongside internal knowledge integration and innovation [10]. Specifically, an organization's competitive advantage arises not only from internal resources but also from difficult-to-imitate competencies within externally embedded bilateral and network relationships. These networks act as crucial interfaces for inter-organizational behaviors and constitute a valuable repository of organizational knowledge [11].

This theory has been further enriched in the digital era. The convergence of digital technology and knowledge-management has revolutionized knowledge-management processes [12]. Digital knowledge-management models in organizations effectively utilize information, engage various stakeholders, and enhance the availability and innovation of internal knowledge by incorporating digital technologies [13]. Digital knowledge-management platforms break down organizational boundaries, accelerate the flow of knowledge, and promote knowledge storage, retrieval, sharing, and utilization [14]. The knowledge-based view provides a solid theoretical framework for understanding the strategic value of inter-organizational knowledge sharing, and the existing research enriches its theoretical connotation in the digital context. Based on the knowledge-based view, this paper reveals the mechanism of digital technology driving inter-organizational knowledge sharing through knowledge flow and trust interaction.

2.1.2. Inter-organizational Knowledge Sharing

Inter-organizational knowledge sharing refers to the process of exchanging knowledge and technology among organizations to collaboratively solve common problems, innovate, and co-create new knowledge by combining existing knowledge in novel ways or reusing it more effectively [15]. This process underscores organizations' ability to reach beyond their boundaries to access broader knowledge and expertise, enabling bidirectional flows of knowledge [16]. Loebbecke et al. (2016) note that inter-organizational knowledge sharing is dynamic and multidimensional and often unfolds within relationships that combine cooperation and competition [17]. Because firms seldom innovate in isolation, diverse external sources of heterogeneous knowledge tend to create greater value for organizations [18]. In contemporary business environments, digital technologies have become a key force reshaping inter-organizational knowledge sharing. For example, Bettiol et al. (2023) highlight the catalytic role of Industry 4.0 technologies in fostering collective knowledge creation and cross-firm innovation, indicating that technological investment can accelerate knowledge-sharing [19]. Additionally, Azyabi (2023) finds that ICT facilitates knowledge exchange, mitigate associated risks, and support the growth of SMEs. These all indicate that sourcing external insights and optimizing the flow of corporate knowledge drive organizational success [20].

2.1.3. Knowledge Flow

Knowledge flow refers to the dynamic movement of knowledge across distinct actors or entities—including spillovers, diffusion, and transfer [21]. The concept of knowledge flow originates in Teece's (1977) examination of technology transfer costs [22], and was further delineated by Szulanski (1996) as a situation-specific process of knowledge-transfer [23]. Scholars have expanded upon the concept of knowledge flow in recent years. Yu et al. (2018) define knowledge flow as the process of knowledge-transfer between subjects or knowledge processing mechanisms [24]. Dalmarco et al. (2019) define knowledge flow in terms of both direction and content of knowledge based on technology transfer [25]. Knowledge flow is characterized by three main features: non-unidirectionality, dynamism and subjectivity. Non-unidirectionality holds that although knowledge is transferred from the transmitter to the receiver, each subject involved in the process can play both roles, i.e., the subject

can also send knowledge outward while receiving it [26]. Dynamism means that knowledge is continuously acquired, developed, disaggregated, stored, and shared during the flow process, which makes it change over time [27]. Subjectivity assumes that subjects are interconnected in the process of knowledge flow and that knowledge is renewed by subjects while expanding the original body of knowledge [28]. The study of knowledge flow provides an important perspective for understanding the dynamic transfer of knowledge among organizations.

2.1.4. Inter-organizational Trust

Inter-organizational trust refers to one party's willingness to cooperate without defensiveness, based on positive expectations about the other party's attitudes and behaviors, and trusting actions that maintain cooperative relationships [29]. Inter-organizational trust is a key situational factor to promote inter-organizational collaboration and knowledge-sharing, which includes relationship trust, emotional trust and ability trust [30]. Dirks and de Jong (2022) note that higher levels of trust reduce conflict in collaboration and promote knowledge-sharing in multi-party interactions [31]. Park and Kim (2018) further propose that trust reduces ambiguity and instability in collaboration, lowers transaction costs and risk, and supports the effective functioning of the knowledge market [32]. Al-Jabri and Al-Busaidi (2018) emphasize that trust, together with organizational culture, shapes an environment conducive to knowledge-transfer, with particularly pronounced effects among SMEs [33]. Collectively, these studies indicate that trust—as a core element of inter-organizational relationships—significantly influences the efficiency and effectiveness of knowledge-sharing. Research on inter-organizational trust offers an important lens for understanding the situational factors of knowledge-sharing.

2.2. Hypotheses Development

2.2.1. Digital Technology and Inter-Organizational Knowledge Sharing

Digital technology expands the scope of knowledge-sharing, enables close collaboration among participants, reduces the stickiness of knowledge, and heightens collaborative productivity. For example, digital platforms break down barriers to knowledge-sharing between organizations, mitigate information asymmetries by increasing openness and relevance, and enable knowledge interaction among diverse subjects [34]. This innovates the way organizations interact with customers, partners, and suppliers [35], and promotes the collaborative participationof many subjects in knowledge activities [5]. Organizations can effectively use social media to bridge the gap between the physical and digital worlds, support informal communication among shared subjects, weaken organizational boundaries [36].

Pervasive digital technologies endow organizations with agility. On the one hand, Internet of Thing (IoT) and big data integrate novel solutions and provide responsive infrastructure for firms to adapt to market changes [37], transforming operations and models. Big data and cloud computing enable organizations to access knowledge from multiple sources and facilitate knowledge-transfer through interaction with knowledge characteristics [38]. IoT enables organizations to share and communicate information for collective decision making [39]. On the other hand, Industry 4.0 and the Industrial Internet balance internal and external stakeholder interests while accumulating data through firm digitization. These expand inter-firm data aggregation for knowledge integration [13], cross-domain exchange [40]. Thus, the following hypothesis is proposed in this paper:

Hypothesis 1: Digital technology has a positive impact on inter-organizational knowledge sharing.

2.2.2. The Mediating Role of Knowledge Flow

As an indispensable asset, knowledge resides in organizations as stocks and flows, accumulated internally and externally [5]. Digital platforms have improved the generation and dissemination of knowledge, increasing the frequency and efficiency of knowledge flow, making it a critical driver of innovation and economic growth [41].

Spatial distance between organizations is a major restriction to inter-organizational knowledge flow [21]. However, digital technology minimizes the cost of exchange by continuously circulating data and connecting dispersed information [42]. As competition moves online, where knowledge diffuses unencumbered, traditional constraints weaken over time [43]. It strengthens inter-organizational connections, creating new social networks. For example, the Internet enhances diffusion capabilities, enabling fluid information exchange and partnerships across distributed entities [44]. Digital knowledge makes interactions between organizations more direct and flatter. Knowledge services and transactions become more responsive and accessible, accelerating transfer efficiency [45], accelerates global knowledge flow [46]. Eslami et al. (2023) find that Industry 4.0 technologies connect supply chain enterprises to create and exchange information in real time [47]. Therefore, this paper makes the following assumption:

Hypothesis 2: Digital technology has a positive impact on knowledge flow.

Knowledge is the most important resource for developing an organization's core competitive advantage, which is mainly disseminated and accumulated through knowledge flow [48]. First, knowledge flow creates a mutually beneficial exchange mechanism that promotes collaborative engagement, transfer, and sharing [49], thereby enhancing inter-organizational knowledge complementarities and broadening organizational knowledge bases. Second, knowledge flow creates an atmosphere conducive to knowledge-sharing and integration [50]. This supports the acquisition of necessary knowledge resources, allowing for continuous knowledge and information transfer between organizations [51]. In addition, extra-organizational engagement in informal settings also allows employees to integrate different skills and perspectives across organizational boundaries [52]. Third, organizations can use internal knowledge to generate additional revenue [53]. Mutual reference between organizations promotes the retention and dissemination of knowledge within a collaborative group [54], and enables rapid absorption and diffusion of resources across organizations. Based on this, this paper proposes the hypothesis:

Hypothesis 3: Knowledge flow positively impacts inter-organizational knowledge sharing.

Knowledge accumulation within an organization is the result of the knowledge exchange [55]. Digital technologies provide platforms and tools for organizations to leverage virtual channels that transcend physical barriers. They help foster collaborative ecosystems that enable extensive extemal engagement and knowledge-sharing. These enable inter-organizational coordination and alliances, while accelerating knowledge flow and evolution, and fostering exchange.

Knowledge flow is the foundation for such transfers. Bi-directional engagement and recurrent knowledge permeation underpin collective learning and growth [56]. Therefore, this paper proposes the following hypothesis:

Hypothesis 4: Knowledge flow plays a mediating role between digital technology and inter-organizational knowledge sharing.

2.2.3. The Moderating Role of Inter-Organizational Trust

Inter-organizational relationships have a significant effect on knowledge-sharing and information flow. Trust-based partnerships are a core element of knowledge-sharing [57]. Informal networks enhance this effect [3]. Owing to potential security risks, they are more willing to share and communicate extensively under conditions of greater psychological safety and trust.

First, Trust enhances commitment and encourages short-term concessions for long-term returns. Qian et al. (2021) argue that more resources need to be invested in organizational relationships [58]. Increased inter-organizational trust and convergence of interests minimize frictional knowledge barriers and facilitate closer exchanges [59]. Second, trusted partnerships strengthen inter-organizational interactions, reuse knowledge gained, and increase organizational foresight and knowledge effectiveness [16]. In addition, Nuruzzaman and Singh (2019) argue that accumulated credibility and goodwill reduce exchange uncertainty, thereby facilitating knowledge-transfer [7]. However, research also shows that more inter-organizational trust is not always better. Villena et al. (2019) reveal the double-edged sword of trust: excessive trust leads to complacency and a lack of critical evaluation [6]. In fact, even sincere trust can backfire: high expectations can make it difficult for the organization to meet those expectations, ultimately reducing partner satisfaction [60]. Based on the above-mentioned trust double-edged sword theory, trust in the digital environment may enhance knowledge flow due to increased information transparency, but excessive trust may lead to complacency or privacy risks in information sharing, thereby weakening collaboration efficiency. Accordingly, the following hypothesis is proposed:

Hypothesis 5: Inter-organizational trust nonlinearly moderates the relationship between knowledge flow and inter-organizational knowledge sharing.

Based on the above theoretical logic, this paper constructs a theoretical model as shown in Figure 1. (See Appendix, the same below)

3. Data and Methods

3.1. Data Collection

Questionnaires are primarily distributed to Industrial Internet enterprises, supply chain organizations, and other strategic alliances across China that engage in business cooperation or collaborative innovation. Examples include high-tech manufacturing, AI, and financial services companies. This is because such groups use digital technologies extensively to collaborate across geographies and industries in an increasingly digital environment to find common ground on design, manufacturing, products or services.

We collected the data through an online platform (https://www.wjx.cn/) in mainland China, which provides functionality similar to Amazon Mechanical Turk. We distributed the questionnaire via emails and online communities from March to June 2023, and received a total of 425 responses. Through a thorough screening process that included checking for screening items, missing values, outliers, we are able to identify 380 valid responses that can be used for statistical analysis. The characteristics of the respondents and the descriptive statistics of their companies are shown in Table 1.

3.2. Variable Measurement

In order to ensure the reliability and validity of the questionnaire, as well as the accuracy of the results, the measures of the relevant variables are primarily established by reviewing previous literature, summarizing previous scholarly viewpoints, and organizing mature scales from existing studies. Specifically, three items are used to measure digital technology. Inter-organizational knowledge sharing is measured by two items. Knowledge flow is measured using two items. Inter-organizational trust is measured by three items. See Table 2 for reference sources and the number of questions for the item.

3.3. Method

AMOS 28.0 and SPSS 26.0 were employed for data analysis, which occurred in two main steps. First, the reliability and validity of the measurement model were assessed before evaluating the structural model relationships. Second, the structural model was tested using SEM and multiple regression. SEM was chosen as the primary method for examining mediation effects for several reasons: it is ideal for analyzing large datasets, suitable for exploratory research designs, and serves as a robust multivariate technique that models causal relationships among latent variables while accounting for measurement error and inter-variable correlations. Additionally, multiple regression analysis was utilized to examine the moderating effect of nonlinearity.

4. Results

4.1. Reliability and Validity Test

As shown in Table 3, Cronbach'α coefficients of each variable all exceed 0.7, indicating high reliability and internal consistency of the questionnaire. Subsequently, KMO and Bartlett's test are conducted (see Table 4). The KMO test value surpasses 0.7, and the Bartlett's test is significant ($P<0.001$), indicating the questionnaire data can be subjected to factor analysis. The factor loading of each variable is above 0.7, all AVE values are above 0.5, and all CR values are greater than 0.7 (see Table 3), indicating that the data has good convergent validity.

To further verify whether the scale has good discriminant validity, the heterotrait-monotrait (HTMT) ratio between the variables is investigated. The HTMT value for paired variables is greater than the strict critical value of 0.85, indicating that the research variables lack discriminant validity. As can be seen in Table 5, the HTMT ratios between the variables are all less than 0.85, indicating that the scale has good discriminant validity.

4.2. Common Method Bias Test

The data for the present study were primarily obtained from a single source via self-reports, which increases the potential risk of common method bias. To mitigate this potential risk, on the one hand, we implemented procedural control

measures. First, the scales in the questionnaire were presented in a randomized item order to disrupt respondents' potential consistency bias. Second, all responses were kept anonymous to reduce social desirability pressure and evaluation apprehension, encouraging a more faithful reflection of respondents' attitudes and behaviors. On the other hand, this paper adopts unmeasured latent method construct (ULMC) technique for factor analysis, compares the CFA model (M1) with the bifactor model (M2) including a common method factor, and observes the changes of each fit index. If the fit index of the model is not significantly improved, it shows that there is no common method bias in the data. As shown in Table 6, ΔRMSEA=0.007, ΔSRMR=0.006, ΔCFI=-0.009, ΔTLI=-0.01, and the change values of each index are less than 0.05, which indicates that the model has not been significantly improved after adding the method factor, suggesting that there is no obvious common method bias problem in this measurement model.

4.3. Hypothesis Test

4.3.1. Main Effect Test

Without considering the mediating effect, this paper constructs a model of digital technology and inter-organizational knowledge sharing (see Figure 2). The model of the relationship between digital technology and inter-organizational knowledge sharing shows that: $\chi 2/df=2.489$, RMSEA=0.063, SRMR=0.059, TLI=0.964, CFI=0.973, and each index basically meets to the fit criteria, which indicates that the model has a good degree of fitness. As shown in Table 7, the coefficient of digital technology on inter-organizational knowledge sharing is 0.502 ($p<0.001$), which demonstrates that digital technology has a direct and significant positive impact on inter-organizational knowledge sharing, and therefore H1 is supported.

4.3.2. The Mediating Effect of Knowledge Flow Test

The mediating role of knowledge flow is tested through the maximum likelihood estimation by constructing a structural equation modeling (see Figure 3). The model fit index: $\chi 2/df=1.892$, RMSEA=0.049, SRMR=0.048, TLI=0.967, CFI=0.972, and each index of the model meets the fit criteria, which indicates that the model reaches an acceptable level and has a good predictive effect. As shown in Table 7, the path coefficient of digital technology on knowledge flow is 0.570 ($P<0.001$), indicating that digital technology has a positive facilitating effect on knowledge flow, and therefore H2 is supported. The path coefficient of knowledge flow on inter-organizational knowledge sharing is 0.527 ($P<0.001$), indicating that knowledge flow has a significant positive effect on inter-organizational knowledge sharing, thus H3 is supported.

This paper applies bootstrap test to set the number of resampling to 5000 and bias-corrected confidence interval to 95%, and tests the robustness of the results. As shown in Table 8, the 95% confidence interval of Bias-corrected for indirect effects [0.166, 0.479] does not contain 0. Therefore, the mediating effect of knowledge flow is valid and the effect value of the mediating effect is 0.301, H4 is verified.

4.3.3. The Moderating Effect of Inter-Organizational Trust Test

As can be seen from Table 9, the confidence interval [-0.079, 0.199] for the interaction term 1 (KF × IOT) contains 0. The interaction term of the primary term of IOT and KF is not significant ($p>0.05$). The confidence interval [0.005, 0.169] for the interaction term 2 (KF × IOT2) does not contain 0. The interaction term of the quadratic term of IOT and KF is significant (B=0.087, t=2.076, $P<0.05$), indicating that inter-organizational trust has a nonlinear moderating effect on the relationship between knowledge flow and inter-organizational knowledge sharing. Therefore, H5 is verified.

As shown in Table 10 and Figure 4, the slope of KF varies with IOT levels. It decreases from 0.532 to 0.524 as IOT rises from -0.805 to 0, and subsequently increases to 0.629 as IOT reaches 0.805. Specifically, at low IOT (-0.805), knowledge flow significantly and positively affects inter-organizational knowledge sharing ($B = 0.532$, $t = 7.107$, $P < 0.001$). At a medium level of inter-organizational trust, knowledge flow still significantly impacts inter-organizational knowledge sharing, though the effect is weaker than at low IOT levels ($0.524 < 0.532$). Conversely, at high IOT (0.805), knowledge flow maintains a significant positive effect on inter-organizational knowledge sharing, and this effect is stronger compared to both low and medium IOT levels.

The findings indicate that varying levels of inter-organizational trust exert distinct effects on inter-organizational knowledge sharing. Trust can facilitate knowledge-sharing by mitigating uncertainty and fostering a greater willingness to share information [57]. However, when organizations become highly familiar, excessive expectations can paradoxically impede knowledge-sharing [60]. Subsequently, as inter-organizational trust deepens, knowledge flow becomes more frequent and inter-organizational exchanges become closer. This may stem from the potential for inter-organizational trust to re-emerge over time, particularly after initial trust issues are resolved, or through the development of stronger collaborative bonds. In such instances, organizations are likely to share knowledge more proactively to maximize mutual benefits.

5. Discussion and Conclusion

We build on the existing literature and capture the important role of knowledge flow. Based on this, we do so by embedding knowledge flow in pathways that enable inter-organizational knowledge sharing. We also investigate the mechanisms by which inter-organizational trust may facilitate inter-organizational knowledge sharing by examining the moderating effect of inter-organizational trust on the relationship between knowledge flow and inter-organizational knowledge sharing.

The findings indicate that knowledge flow plays a significant mediating role between digital technologies and inter-organizational knowledge sharing, although their effectiveness may be constrained by the type of knowledge and the compatibility of the technological infrastructure. The nonlinear moderating effect of inter-organizational trust manifests as follows: low trust can facilitate knowledge flow, whereas high trust may foster complacency and erode collaborative efficiency. Over time, however, inter-organizational trust can again strengthen the effect of knowledge flow on inter-organizational knowledge sharing. This contradicts the conventional linear trust assumption and underscores the complex ways in which digital environments shape trust dynamics.

5.1. Theoretical Implications

Digital capabilities are now pervasive in the knowledge economy, enhancing inter-organizational communication and coordination. Consequently, the adoption of digital technologies is becoming crucial for organizational

development. This study acknowledges and empirically confirms that digital technology's evolution is not merely a tool, but a catalyst reshaping inter-organizational knowledge sharing. While digital technology's role in fostering knowledge-sharing within organizations is acknowledged (e.g., Deng et al., 2023 [61]), research on its impact on inter-organizational knowledge sharing remains limited [62]. This gap hinders a comprehensive understanding of how organizations can effectively leverage and integrate new digital technologies for this purpose. Therefore, this paper empirically demonstrates the quantitative effects of digital technology on knowledge flow between organizations, thereby deepening our understanding of this phenomenon and enriching the KBV within the digital context.

While some studies have examined knowledge exchange in inter-organizational collaboration [48], the direction of knowledge flow between organizations remains under-investigated. Considering knowledge flow's central role in collaboration, studying knowledge flow-oriented knowledge-sharing can offer valuable insights into the genesis and evolution of inter-organizational knowledge sharing. Digital technology's facilitation of knowledge flow [63], and enhancement of inter-organizational knowledge sharing [49] has been suggested, but these are unilateral perspectives. Although theoretically proposed, the mediating role of knowledge flow between digital technology and inter-organizational knowledge sharing lacks empirical validation. Therefore, this paper develops a theoretical model and quantitatively tests its feasibility. Building on prior research, it empirically validates the mediating role of knowledge flow and quantitatively demonstrates how knowledge becomes a transformative factor in organizational practice driven by digital progress. This mediation perspective represents a gap in the existing literature, both in exploration and quantitative validation, offering a valuable reference point for future theoretical and empirical research.

Despite extensive research on inter-organizational trust and knowledge-sharing, findings remain equivocal and conflicting. This paper revisits the impact of inter-organizational trust on knowledge-sharing and further uncovers its non-linear moderating characteristics. Our findings align with Villena et al. (2019) [6]. The conventional linear view of inter-organizational trust is well-established. For example, Chen et al. (2014) emphasized the positive influence of inter-organizational trust, enabling knowledge exchange partners to cultivate collaborative relationships, which, in turn, positively affects inter-organizational knowledge sharing [57]. However, inter-organizational trust does not exert a consistently positive influence; trust dynamics in the digital environment can deviate from linear expectations. Our study further substantiates this notion and offers novel insights for future research on inter-organizational trust.

5.2. Practical Implications

Enhancing digital maturity and knowledge-transfer capability requires proactive coordination among policymakers and ecosystem-level stakeholders. Policymakers should establish regulatory frameworks for inter-organizational data sharing and knowledge flow, and incentivize the development of shared digital infrastructure and collaborative platforms. Ecosystem participants, such as industry associations, should advance industry standards and joint innovation initiatives, lower collaboration barriers, build system-level trust, and attract partners to engage in knowledge-sharing and innovation.

Integrate advanced digital technologies and leverage their novel architectures and processes to drive organizational digital transformation and raise digital maturity. Knowledge managers should proactively integrate technologies to redesign processes and structures for seamless knowledge flow, including deploying dedicated platforms that support internal and external collaboration. At the same time, organizations need to cultivate an open and inclusive culture of knowledge flow. Knowledge managers should champion and implement effective mechanisms for knowledge contribution and exchange, use digital platforms to facilitate knowledge-sharing, and help the organization adapt, learn, and improve innovation performance.

Organizations should attract partners to participate in knowledge-sharing and innovation activities. By collaborating with other organizations, firms can access richer knowledge resources and innovative thinking, thereby promoting continuous development and enhancing competitiveness. Organizations and knowledge managers need to establish transparent, well-governed partnerships to increase inter-organizational trust and to enable stable and sustainable knowledge-transfer and learning. Organizations should also implement appropriate safeguards to strengthen the monitoring of trust relationships, avert potential crises that could threaten collaboration, and reduce information asymmetries and collaboration risks.

6. Limitations and Future Directions of Research

While this paper offers valuable insights, certain limitations warrant consideration. First, the generalizability of the findings may be limited by the sample source. Future research should broaden the sampling scope to include a wider range of regions, industries, and organizational types, thereby enhancing the generalizability of the results. Second, as this study primarily adopts a quantitative approach, it is limited in its ability to capture participants' subjective perceptions, the specific mechanisms, and the nuanced details of how digital technology influences trust and knowledge-sharing. Future studies should consider employing a mixed-methods approach that integrates quantitative analyses with qualitative methods such as interviews. Such an approach would facilitate a more comprehensive understanding of the quantitative findings and uncover the deeper processes through which technology exerts its effects. Finally, future research should further expand the exploration of knowledge flow. For example, it could examine the conditions and influencing factors—such as situational or organizational elements—under which knowledge flows act as a mediating variable. It could also compare the differences in knowledge flows across industries or organizational types.

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Appendix

Figure

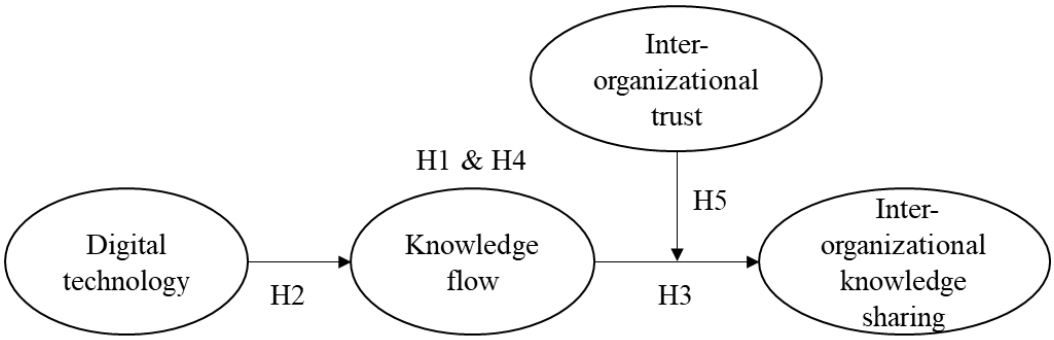


Figure 1. Theoretical model

Note: H1 refers to the direct effect of digital technology on inter-organizational knowledge sharing, while H2 refers to the indirect effect of knowledge flow.

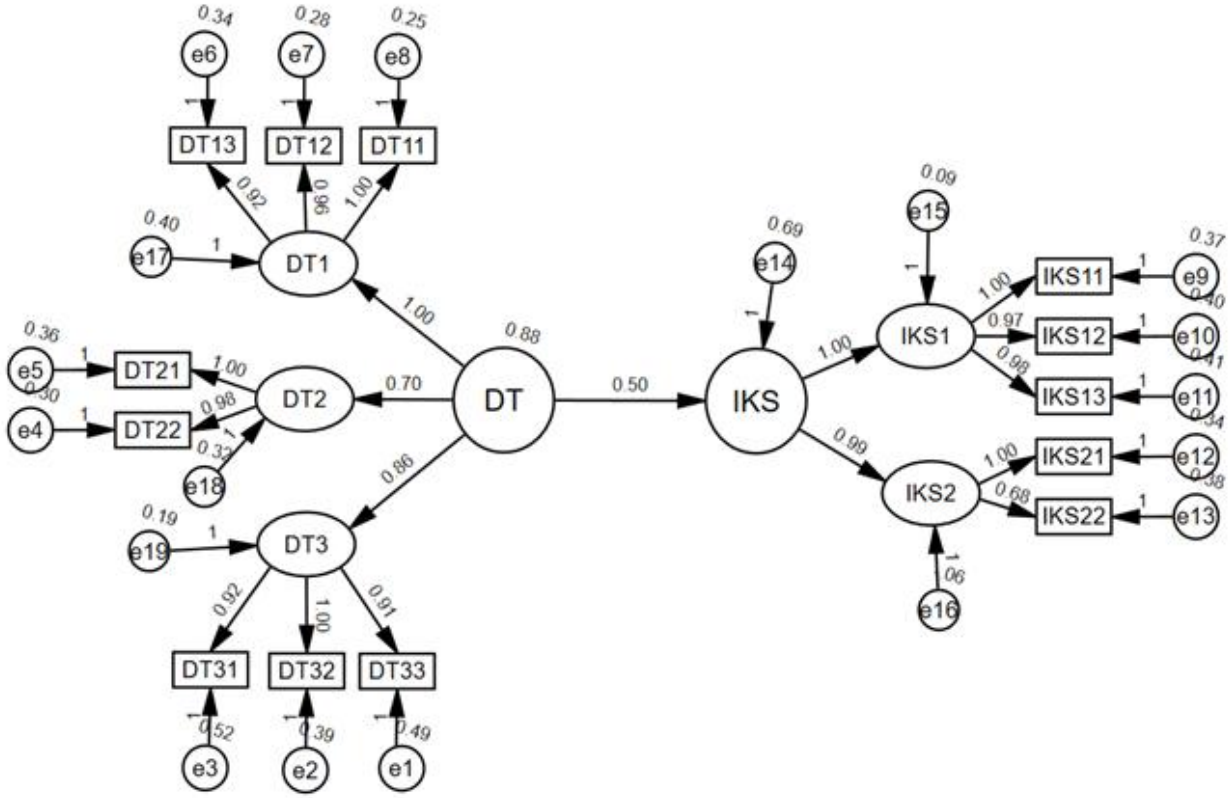


Figure 2. Main effect model

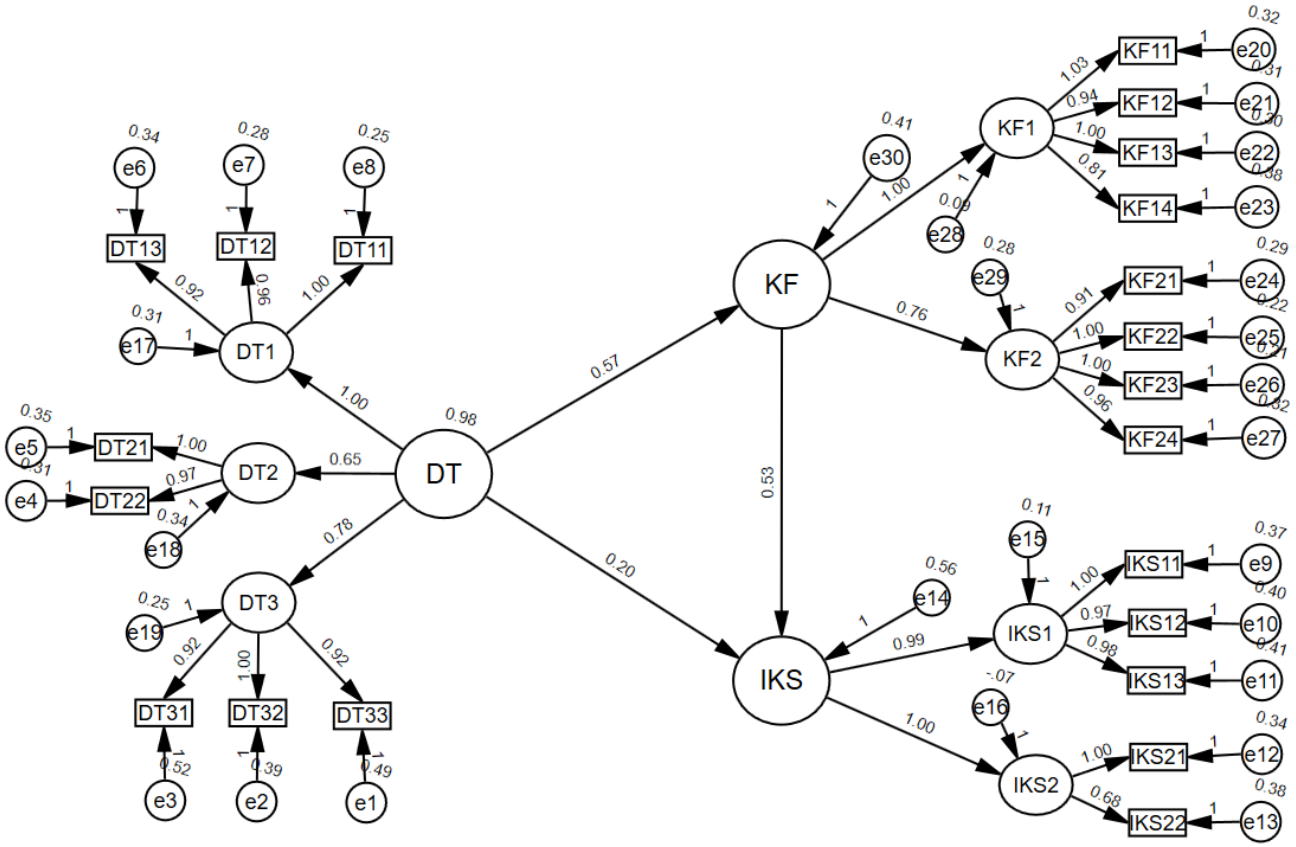


Figure 3. Mediating effect model

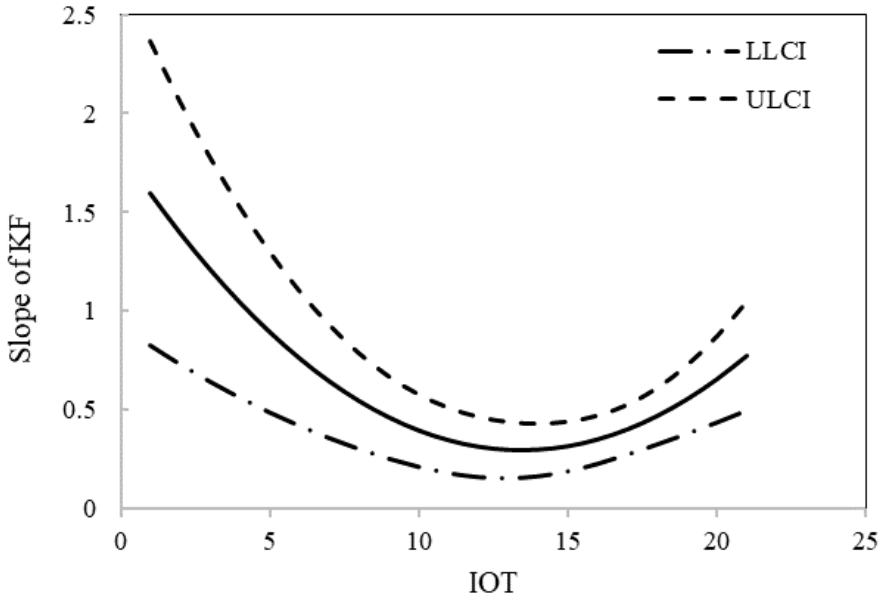


Figure 4. The moderating effect of inter-organizational trust

Table

Table 1. Basic information of survey subjects (n=380)

Basic information	Category	Frequency	Percentage
Staff position	General staff	79	20.79%
	Junior managers	97	25.53%
	Middle managers	119	31.32%
	Senior managers	85	22.37%
Years of establishment	Less than 5 years	102	26.84%
	6-10 years	114	30.00%
	10-20 years	96	25.26%
	Over 20 years	68	17.89%
Organizational scale	Less than 100 people	91	23.95%
	100-500 people	122	32.11%
	500-1000 people	101	26.58%
	More than 1000 people	66	17.37%

Table 2. Variable Measurement

Variable	Item	Indicator	Reference source
DT	Management (DT1)	3	Ardolino et al. (2018) [64], Raudeliuniene et al. (2021) [65]
	Plan (DT2)	2	
	Excavation (DT3)	3	
IKS	Knowledge Interaction (IKS1)	3	Ali et al. (2018) [66], Chen et al. (2014) [57]
	Knowledge Collaboration (IKS2)	2	
KF	Quote (KF1)	4	Forman and Van Zeebroeck (2019) [63], Duan et al. (2022) [67]
	Exchange (KF2)	4	
IOT	Relationship Trust (IOT1)	3	Chen et al. (2014) [57], Lee et al. (2012) [30]
	Emotional Trust (IOT2)	2	
	Ability Trust (IOT3)	2	

Note: DT, digital technology. KF, knowledge flow. IKS, inter-organizational knowledge sharing. IOT, inter-organizational trust. Indicator, the number of questions for the item.

Table 3. Variable items and measurement results

Variable	Item	Indicator	Factor loading	Cronbach's α	AVE	CR
DT	DT1	DT11	0.905	0.920	0.803	0.924
		DT12	0.909			
		DT13	0.873			
	DT2	DT21	0.831	0.817	0.691	0.817
		DT22	0.831			
	DT3	DT31	0.74	0.830	0.617	0.828
		DT32	0.833			
		DT33	0.78			
KF	KF1	KF11	0.842	0.900	0.686	0.897
		KF12	0.848			
		KF13	0.873			
		KF14	0.745			
	KF2	KF21	0.804	0.910	0.712	0.910
		KF22	0.879			
		KF23	0.886			
		KF24	0.802			
IKS	IKS1	IKS11	0.883	0.880	0.712	0.881
		IKS12	0.797			
		IKS13	0.849			
	IKS2	IKS21	0.775	0.740	0.601	0.751
		IKS22	0.775			
IOT	IOT1	IOT11	0.844	0.860	0.664	0.856
		IOT12	0.828			
		IOT13	0.771			
	IOT2	IOT21	0.835	0.819	0.697	0.822
		IOT22	0.835			
	IOT3	IOT31	0.803	0.783	0.645	0.784
		IOT32	0.803			

Note: DT, digital technology; KF, knowledge flow; IKS, inter-organizational knowledge sharing; IOT, inter-organizational trust.

Table 4. KMO and Bartlett's test results

KMO test	Bartlett's test		
	Approximate chi-square	Degree of freedom	Significance
0.922	7302.333	378	0.000

Table 5. HTMT test results

	DT1	DT3	DT2	KF1	KF2	IKS1	IKS2	IOT1	IOT2	IOT3
DT1										
DT3	0.622									
DT2	0.518	0.611								
KF1	0.559	0.398	0.362							
KF2	0.423	0.343	0.336	0.681						
IKS1	0.480	0.293	0.192	0.481	0.396					
IKS2	0.442	0.318	0.251	0.485	0.447	0.804				
IOT1	0.464	0.330	0.255	0.301	0.242	0.252	0.240			
IOT2	0.226	0.325	0.320	0.133	0.197	0.078	0.125	0.558		
IOT3	0.280	0.353	0.316	0.208	0.227	0.182	0.221	0.590	0.552	

Table 6. Common method bias test results

Model	RMSEA	SRMR	CFI	TLI
M1	0.038	0.034	0.977	0.971
M2	0.031	0.028	0.986	0.981
Δ	0.007	0.006	-0.009	-0.01
Recommended value	<0.05	<0.05	<0.1	<0.1

Table 7. Results of Structural Equation Modeling

Hypothesis	Path	Coefficient	S.E.	C.R.	P
H1	DT→IKS	0.502	0.066	7.656	***
H2	DT→KF	0.570	0.055	10.371	***
H3	KF→IKS	0.527	0.095	5.527	***

Note: *** $p<0.001$

Table 8. Results of mediation effect test

Path	Effect	S.E.	Lower	Upper
DT→KF→IKS	0.301	0.079	0.166	0.479
DT→IKS	0.495	0.076	0.347	0.644

Table 9. Results of nonlinear moderating effect analysis

Variable	B	β	S.E.	VIF	t	LLCI	ULCI	p
KF	0.524	0.446	0.061	1.436	8.549	0.404	0.645	***
IOT	0.154	0.132	0.059	1.334	2.628	0.039	0.270	**
IOT^2	0.164	0.113	0.060	2.031	2.738	0.046	0.281	**
KF×IOT	0.060	0.041	0.071	1.909	0.848	-0.079	0.199	0.397
KF×IOT^2	0.087	0.048	0.042	2.979	2.076	0.005	0.169	*

Note: * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 10. Results of simple slope analysis

IOT	Slope	SE	t	LLCI	ULCI	p
-0.805	0.532	0.075	7.107	0.385	0.680	***
0	0.524	0.061	8.549	0.404	0.645	***
0.805	0.629	0.082	7.666	0.468	0.790	***

Note: *** $p<0.001$