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Article

The analysis of a causal model of learning organization on sustainable organizational performance of public IT companies in China: Knowledge management practices and innovation capability as multiple mediators

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Abstract: This research aims to empirically examine the role of learning organization practices in enhancing sustainable organizational performance, utilizing knowledge management and innovation capability as mediating variables. The study was conducted in public IT companies across China, which is a vital sector for driving innovation and economic growth. A mixed-methods approach was employed, with quantitative methods accounting for 70% and qualitative methods for 30% of the research. Purposive sampling was utilized to distribute questionnaires to 546 employees from 10 public IT companies. Statistical analysis was conducted using Structural Equation Modeling (SEM). The findings indicate that learning organization practices significantly influence knowledge management practices ($\beta = 0.785$, $p < 0.001$) and innovation capability ($\beta = 0.405$, $p < 0.001$). Furthermore, knowledge management practices positively contribute to sustainable organizational performance ($\beta = 0.541$, $p < 0.001$), while innovation capability also has a positive effect ($\beta = 0.143$, $p < 0.001$). Moreover, knowledge management practices partially mediate the relationship between learning organization practices and sustainable performance, with a total effect of 0.788 ($p < 0.001$). The mediating role of innovation capability is also significant, with a total effect of 0.422 ($p = 0.045$). The study further includes qualitative in-depth interviews with 20 managers from 10 IT companies across five regions in China: East, South, West, North, and Central. Senior managers were selected through a stratified sampling method to ensure comprehensive representation by including both the largest and smallest companies in each region. These findings underscore the critical role of learning organizations in promoting sustainability through effective knowledge management and innovation capabilities within the IT sector.

Keywords: learning organization; knowledge management practices; innovation capability; sustainable organizational performance

1. Introduction

In the context of knowledge-based economies, the interplay between learning organizations, knowledge management practices, and innovation capability is vital for enhancing sustainable organizational performance. As organizations in the fast-paced IT industry prioritize continuous learning and adaptability, effective knowledge management becomes indispensable for capturing, sharing, and applying knowledge to foster innovation and sustainability. Evidence suggests that robust knowledge management processes significantly bolster green innovation, thereby supporting long-term performance (Asril et al., 2023). Furthermore, innovation capability is critical in utilizing knowledge to create products and processes that meet sustainability objectives, enhancing both competitiveness and operational resilience (Zhou, 2023).

For Chinese public IT companies, integrating these elements is paramount for navigating technological transformations and achieving sustainable success. Learning organizations encourage continuous learning and knowledge-sharing, essential for responding to rapid technological changes. Effective knowledge management practices maximize the use of intellectual capital across the organization, promoting innovation and sustainable outcomes (Shahzad et al., 2020). By leveraging these mediators, firms can enhance their adaptability and competitiveness in both domestic and global markets (Yang, 2023).

This research addresses the intertwined challenges of sustainable performance through learning organizations, knowledge management, and innovation capability, equipping companies to enhance resilience and adaptability. For Chinese public IT firms, embedding effective knowledge management practices is crucial for sustaining innovation and preserving competitiveness on national and international stages (Al-Sous et al., 2023). Notably, the integration of green innovation practices, supported by efficient knowledge management systems, particularly enhances sustainable performance in the knowledge-intensive IT sector (Khan et al., 2024). This focus not only facilitates long-term value creation but also aligns with environmental sustainability goals—critical for maintaining competitiveness globally. In 2023, China's public IT sector contributed 7.8% to the nation's GDP and employed over 20 million people (MIIT, 2023). The 6.2% growth in IT-related enterprises, primarily in software development and technological services, underscores the urgent need for public IT firms to innovate and adopt sustainable practices amidst increasing market competition (CNNIC, 2023).

This study, therefore, aims to enhance the understanding of several key areas. First, it will investigate the factors of learning organizations that significantly impact the sustainable performance of Chinese public IT companies. Second, it will explore the challenges these firms face in integrating knowledge management practices and innovation capability, which serve as mediators affecting sustainable performance. Finally, the study intends to propose a model illustrating how learning organizations impact the sustainable performance of public IT companies in China.

2. Literature review

A learning organization is essential for driving long-term growth and adaptability in dynamic business environments. Similar to the notion of competitive advantage, a learning organization provides enterprises with the ability to continuously improve and innovate, positioning them ahead of competitors. Organizational learning theory posits that firms with robust knowledge management systems and adaptive learning cultures can better respond to external challenges and uncertainties (Finnestrand, 2023). These organizations leverage knowledge acquisition and dissemination, enabling the transformation of individual and collective learning into organizational capabilities. By fostering a culture of continuous learning, firms can enhance employee resilience and engagement, leading to sustained organizational performance. As technology plays an increasingly significant role, leadership practices that emphasize digital transformation and data-driven decision-making further strengthen the learning organization framework (Banoğlu et al., 2023). Research highlights that

organizations that invest in learning capabilities are better equipped to innovate, enhance operational efficiencies, and navigate complex market conditions, thus creating a sustainable learning environment with high barriers to imitation (Ju et al., 2021). However, further exploration is needed to understand the external and internal factors influencing the development of these learning capabilities and their scalability across different organizational contexts.

2.1. Knowledge management practices

Knowledge management practices have become increasingly crucial in the rapidly evolving knowledge economy, where enterprises face heightened market competition and a volatile environment. Effective knowledge management emphasizes decentralization, promoting flexibility, and facilitating an organizational structure that supports knowledge sharing and collaborative innovation (Uhl-Bien et al., 2007). The contingency theory, which emphasizes the need to align organizational strategies with internal and external environments, also applies to knowledge management practices. No single knowledge management model is universally applicable, and organizations must adapt their practices to align with environmental and strategic conditions (Ruekert et al., 1985).

In this context, knowledge management that adapts to organizational and environmental changes leads to improved team performance, organizational effectiveness, and strategic alignment (Ali et al., 2023). As organizations become flatter and more decentralized, knowledge management practices must ensure that employees, leaders, and the organization as a whole co-evolve, allowing for the acquisition and optimization of high-quality knowledge resources (Sangalang et al., 2024). This alignment of knowledge management with organizational objectives is crucial for fostering sustainable organizational development and enhancing long-term competitiveness.

This alignment between knowledge management and organizational objectives fosters sustainable organizational development, thereby enhancing long-term competitiveness. Recent research echoes these themes, demonstrating that knowledge management capabilities significantly improve organizational performance, particularly through the mediating effect of organizational agility and the moderating influence of business model innovation (Idrees et al., 2022). Thus, decentralized knowledge management systems and aligned organizational objectives not only contribute to short-term success but also drive sustained competitive advantage over time.

Organizational support theory posits that employees who perceive support from their organization in knowledge management initiatives are more likely to contribute positively to the organization's knowledge base, exhibit enthusiasm for their work, and align their behaviors with corporate objectives (Cugueró-Escofet et al., 2019). Knowledge management practices that emphasize inclusivity, knowledge platform building, and optimization encourage a culture where employees feel valued and are motivated to contribute, enhancing both individual and collective performance. The resource-based view (RBV) of the firm further highlights the importance of unique, non-imitable knowledge resources in sustaining a competitive advantage (Novianti,

2019). Knowledge management practices that create valuable, scarce, and irreplaceable resources provide organizations with a sustained competitive advantage that is difficult for competitors to replicate. Moreover, the integration of contingency theory into knowledge management practices suggests that aligning these practices with external and internal organizational environments can result in long-term, continuous benefits for the organization (McAdam et al., 2019).

2.2. Innovation capability

Innovation capability refers to an organization's ability to adapt, respond, and drive changes in competitive environments through various forms of innovation, which are critical for long-term success and competitive advantage (Adinata et al., 2023; Kartiraharjo and Isfianadewi, 2021; Musa, 2022; Rhee and Stephens, 2020). It encompasses several key dimensions: product innovation, process innovation, technological innovation, market innovation, and behavioral innovation (Veiga et al., 2024).

Product innovation involves creating new or significantly improved products that require exploratory learning and collaboration with external entities, while process innovation focuses on enhancing efficiency and effectiveness through incremental improvements or radical changes, such as automation (Abdelaziz et al., 2023; Chen et al., 2022). Additionally, knowledge-sharing activities and absorptive capacity are essential for enhancing innovation performance, particularly in multinational enterprises where product and process innovations rely heavily on effective collaboration across subsidiaries (Chatterjee et al., 2022).

Organizations with strong technological innovation capabilities are able to leverage advanced technologies such as artificial intelligence, big data, and the Internet of Things (IoT) to improve their products, services, and processes (Akter et al., 2023). Technological innovation requires both exploratory and exploitative learning, as firms must explore emerging technologies while exploiting current technological competencies to stay ahead of competitors. Technological innovation emphasizes the creation or adoption of cutting-edge technologies to drive both product and process improvements, leveraging tools such as artificial intelligence and IT (Yator and Kipchumba, 2023).

Market innovation involves identifying new opportunities, developing innovative marketing strategies, and adapting business models to meet evolving customer needs (Akhtar, 2023). Lastly, behavioral innovation fosters a culture of creativity and adaptability, where leadership encourages both exploratory and exploitative learning to enhance overall innovation capability (Nawangsari and Sutawidjaya, 2020).

2.3. Sustainable organizational performance

Sustainable organizational performance is a critical concept in modern business, encompassing three key dimensions: environmental, economic, and social performance. These dimensions collectively ensure that firms can achieve long-term success while balancing their responsibilities toward the environment, society, and financial stability (Dilrukshi and Aluthge, 2024).

Environmental performance is increasingly viewed as essential to corporate sustainability. Firms that adopt green innovation practices—such as energy-efficient technologies and sustainable resource management—demonstrate improved environmental outcomes. For example, integrating green absorptive capacity into business strategies allows organizations to better adopt eco-friendly practices, leading to significant enhancements in environmental sustainability (Baeshen et al., 2021). Similarly, green human resource management has been found to positively influence environmental performance by aligning employee engagement and innovation with sustainability goals (Jawaad et al., 2022).

Economic performance is equally integral to sustainability, with firms striving for financial success through ethical practices and long-term value creation. Research has shown that Environmental, Social, and Governance (ESG) disclosure plays a critical role in improving corporate sustainability, particularly in enhancing economic outcomes. Effective ESG implementation enables firms to achieve financial gains while meeting sustainability objectives (Alsayegh et al., 2020). Moreover, sustainable business models focusing on resource efficiency and operational resilience have been found to support superior financial performance, highlighting the interconnectedness of economic and environmental sustainability (Cosenz et al., 2024).

Social performance emphasizes an organization's commitment to societal well-being, including fair labor practices, community engagement, and gender equality. Corporate Social Responsibility (CSR) initiatives that prioritize social justice and equality positively impact an organization's overall social performance. For instance, gender equality and financial transparency have been identified as important contributors to social sustainability, ensuring that organizations not only achieve financial success but also foster societal well-being (Herghiligiu et al., 2023). Leadership that fosters a knowledge-sharing culture and emphasizes social value creation further enhances both social and organizational performance (Sarfraz and Ivascu, 2023).

In summary, the integration of environmental, economic, and social strategies is essential for organizations aiming to achieve sustainable organizational performance. The balance of these dimensions enables companies to address stakeholder expectations, contribute positively to global sustainability goals, and secure long-term competitive advantage.

3. Research hypothesis

This paper proposes the following hypotheses:

Research supports the dynamic relationship between organizational learning and knowledge management practices. Kordab et al. (2020) found that while organizational learning enhances knowledge management processes and sustainable performance, its effect on knowledge creation remains limited. Stary and Fleischmann (2011) emphasized that organizational process memory and communication are vital for increasing adaptability through learning. Saied et al. (2021) demonstrated that learning organizations mediate the relationship between knowledge management and service quality, while Abdullah et al. (2013) indicated that both organizational learning and knowledge management directly influence performance. Moreover, Abu-Shanab

et al. (2014) highlighted the necessity of knowledge sharing for continuous learning and achieving competitive advantage. Acevedo and Diaz-Molina (2023) further underscored the role of knowledge management in fostering an innovative culture within learning organizations. Collectively, these studies affirm that organizational learning drives knowledge management, which subsequently enhances the effectiveness of learning organizations.

H1: Learning organizations have a significant direct effect on knowledge management practices.

Research supports a positive relationship between learning organizations and sustainable performance. Kordab et al. (2020) reported a positive impact of organizational learning on both knowledge management and sustainable performance within the audit and consulting sectors in the Middle East. Kun (2022) found that knowledge management mediates corporate sustainability, with frugal innovation playing a crucial role. Valmohammadi et al. (2019), Abbas and Sağsan (2019) linked knowledge management practices to green innovation and sustainable development. Sapta et al. (2021) highlighted knowledge management's mediating role between organizational culture, leadership, and performance. Wang et al. (2022) emphasized the importance of green knowledge management in achieving sustainable development goals, while Jilani et al. (2020) demonstrated the positive influence of knowledge sharing on sustainable performance. Together, these studies affirm that knowledge management plays a critical role in promoting sustainable organizational performance.

H2: Learning organizations have a significant indirect effect on sustainable organizational performance through knowledge management practices.

Recent studies in organizational development have explored the impact of learning organizations on sustainable performance, identifying key factors and challenges. Inthavong et al. (2023) and Kim et al. (2017) highlighted innovation, networking, and knowledge management as essential for enhancing both sustainable and financial performance. Zgrzywa-Ziemak and Walecka-Jankowska (2020) stressed the importance of business sustainability and adaptive performance. The role of organizational culture in fostering performance and innovation is further emphasized by Mrisha (2017), who focuses on inquiry, dialogue, and interconnected systems. Chen and Zheng (2022) as well as Mollah et al. (2023) highlighted the integration of resources and IT capabilities as critical drivers of performance. However, challenges remain, as noted by Kim (2016), Zgrzywa-Ziemak and Walecka-Jankowska (2020), particularly in establishing direct links between learning organizations and financial outcomes. Rays et al. (2022), Iqbal and Ahmad (2021) emphasized the overshadowing effects of organizational culture, reputation, and sustainable leadership on learning and performance. Lastly, Faulks et al. (2021) highlighted the role of innovative work behavior and transformational leadership in enhancing economic performance and organizational learning, while Kordab et al. (2020) explored the mediating role of the knowledge management cycle between learning and sustainable performance.

H3: Learning organizations have a significant direct effect on sustainable organizational performance.

Research on learning organizations reveals their significant role in enhancing innovation and business performance. Fanbasten (2014) found that learning

organizations and knowledge sharing positively influence innovation and performance, with innovation acting as a mediator. Similarly, Hamdani and Susilawati (2018) showed that information system technology boosts innovation in learning organizations, though its impact on product innovation is limited. Ismail (2005) highlighted the strong contribution of learning organizations to innovation outcomes, while Alipour and Karimi (2011), Lam and Lundvall (2006) showed that knowledge sharing drives innovation and performance. Anwar and Niode (2017), Liao (2006) emphasized the role of work engagement and knowledge sharing in promoting employee innovation, with Park et al. (2014) confirming that work engagement serves as a mediator. Overall, these studies affirm the importance of learning organizations in fostering innovation and driving business success.

H4: Learning organizations have a significant direct effect on innovation capability.

Recent research highlights the critical role of innovation capability in enhancing sustainable organizational performance. Asad et al. (2018) found that product, process, marketing, and organizational innovation significantly impact financial, customer, internal process, and growth performance. Prajogo and Ahmed (2006) confirmed strong links between innovation capacity and organizational performance. Sawaean and Ali (2020) demonstrated that entrepreneurial leadership and learning orientation positively influence performance, with innovation capability serving as a mediator. Su et al. (2018) emphasized the mediating role of innovation capability in improving performance, while María Ruiz-Jiménez and del Mar Fuentes-Fuentes (2013) noted its mediation between knowledge capability and performance. Migdadi (2022) supported these findings, showing that knowledge management enhances innovation and performance. Alshura et al. (2023) stressed the role of organizational commitment in strengthening innovation's impact on performance, while AlTaweel and Al-Hawary (2021) highlighted the influence of strategic agility on innovation and performance.

H5: Learning organizations have a significant indirect effect on sustainable organizational performance through innovation capability.

In conclusion, innovation capability serves as a crucial mediator in the relationship between organizational factors and sustainable performance. This highlights its significance in providing a strong theoretical and empirical foundation for its application in attaining competitive advantage and ensuring long-term success. Building on the aforementioned hypotheses, this study proposes the following research framework (see **Figure 1**).

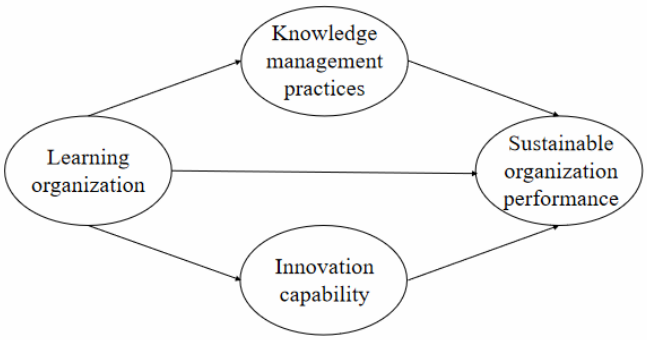

Figure 1. Research framework.

4. Research methodology

4.1. Data collection and sample

To verify the hypotheses, we designed a questionnaire to gather primary data. The survey was conducted from April 1 to 30 August 2024. Most of the scales used in the questionnaire were well-established and widely adopted in academic literature. To ensure the clarity and relevance of the data, we first conducted a preliminary survey with 40 individuals, including managers, EMBA, and MBA students, who had long-standing cooperative relationships with the research team. Their feedback was instrumental in refining the questionnaire, ensuring that respondents could fully comprehend each question. The pre-survey data were not included in the final dataset.

4.2. Sample selection and regional consideration

In the Quantitative Research Methods section, given the size and diversity of China, we use stratified sampling across five distinct regions—Eastern, Southern, Northern, Western and Central—to ensure comprehensive coverage and control of regional cultural and locational influences. This approach allows us to capture a representative sample of Public IT companies in China's diverse economic environments. We selected companies from each region, ensuring that both the largest and smallest Public IT companies come from five regions total of 10 were included to reflect a wide range of organizational capabilities and challenges. A total of 600 questionnaires were distributed according to the percentage of the company's employees in the surveyed population. 222 questionnaires were distributed in the east, 102 questionnaires in the south, 78 questionnaires in the west, 120 questionnaires in the north, and 78 questionnaires in the central region, of which 561 were recovered and 546 were valid. The participants in our study are middle and senior managers from public IT companies who are actively engaged in innovation and competitiveness, as our focus is on the study of the influencing factors of learning organizations on sustainable organizational performance. By ensuring balanced representation from across the country, we minimize the variability that comes with regional differences while still capturing the unique dynamics of each region.

In the qualitative research methods section, a semi-structured in-depth interview (SSI) format will be employed to gather expert insights. This approach will target a select group of 20 senior employees, encompassing both managers from the company's Human Resources Management department and individuals who have accrued over a decade of experience working in this specific department. In every region, there are four interviewees, two from the large one and two from the small one. In a company, the interviewees are managers and an employee from another position.

4.3. Data collection process

In the quantitative section, the data is collected using online methods. The online questionnaire will be sent to the company's public mailbox, and the company's human resources management department will distribute the online questionnaire link directly to the target managers on our behalf. A total of 600 questionnaires were distributed and a total of 561 questionnaires were collected, of which 15 surveys with incomplete

or random responses were discarded, resulting in 546 valid responses. The detailed characteristics of sampled firms are shown in **Table 1**.

Table 1. Profile of sampled firms.

Demographic Characteristic	Category	Frequency	Percentage (%)
Gender	Male	280	51.28
	Female	266	48.72
Age	18–35	335	61.36
	36–55	189	34.62
	Over 55	22	4.03
Education level	Junior College	57	10.44
	Undergraduate	223	40.84
	Master	160	29.3
	PH.D.	40	7.33
	Others	66	12.09
Position in the company	Marketing operations	115	21.06
	Programmer	140	25.64
	Product Manager	110	20.15
	Graphic Designer	69	12.64
	Human Resources Manager	112	20.51
Work experience	Less than 2 years	216	39.56
	2 years–5 years	181	33.15
	5 years–7 years	69	12.64
	7 years or more	80	14.65

In the qualitative part, 20 leaders and managers from different IT companies, ranging from ages 35 to 55 years, were interviewed for this study. There were 3 females and 17 males. Working years and experience are more than 10 years.

4.4. Variables and measures

Table 2. List of 20 interviewees from 10 companies in the east, south, north, west and central region of China.

No	Area	Provinces	Companies	Location	Years
1	East	Zhejiang	Perfect World Co., Ltd.	Manager	10
2				Supervisor	13
3		Shandong	Sublime China Information Co., Ltd.	HR manager	23
4				Supervisor	14
5	South	Guangdong	(Rastar Group) Rastar Interactive Entertainment Co., Ltd	Department head	10
6				Department head	12
7		Guizhou	Shijihengtong Technology Co., Ltd.	Supervisor	11
8				HR manager	16

Table 2. (*Continued*).

No	Area	Provinces	Companies	Location	Years
9	West	Shanxi	Three's Company Media Group Co., Ltd.	Department head	19
10				Department head	20
11		Chongqing	Giant Network Group Co., Ltd.	Department head	20
12				Department head	23
13	North	Beijing	Beijing Ultrapower Software Co., Ltd.	HR manager	18
14				Department head	25
15		Jilin	Tonghua Grape Wine Co., Ltd.	Supervisor	17
16				Department head	15
17	Centre	Hunan	Huakai Yibai Technology Co., Ltd.	Supervisor	14
18				HR manager	22
19		Hunan	Tangel Culture Co., Ltd.	Supervisor	10
20				HR manager	16
20	5	9		20	

This section introduces the Dependent variable, Mediator variables and independent variables. It also presents descriptive statistics and the correlation matrix for all variables (**Table 2**).

4.5. Main research variable

To ensure the reliability and validity of the questionnaire, this study mainly referred to the relevant scales published in authoritative journals to measure the main variables. We revised and improved the scale by using trial surveys and discussions with experts. The questionnaire consists of four parts, including 1 independent variable measure, two mediating variable measures, and 1 dependent variable measure. All measures were adapted from existing scales found in previous studies. The learning organization measures were taken by Pokharel and Choi (2015) and the knowledge management practices were measured by Kordab et al. (2020). In addition, the innovation capacity measurement was taken from Calik et al. (2017). Finally, the measurement of sustainable organizational performance is mainly based on Abdul-Rashid et al. (2017). This study conducted a box-ticking survey. All items in the constructed measure are measured using a 5-point Likert scale ranging from "strongly disagree = 1" to "strongly agree = 5".

5. Results and discussion

5.1. Measurement model analysis

We also measured the convergence and discriminant validity of the structure. The convergence validity of the construct was assessed using composite reliability (CR) and mean-variance extraction (AVE) values (Fornell and Larcker, 1981; Hair et al., 2013). **Table 3** shows the Cronbach α and CR values for each construct, and the Cronbach α and CR values for each construct are calculated separately. All constructs 'Cronbach' α values ranged from 0.906 to 0.912, exceeding the recommended

minimum of 0.70 (Fornell and Larcker, 1981). All factor loads were above 0.65, indicating strong convergence validity (Anderson, 1987). In addition, all CR values were greater than 0.828 and greater than the minimum acceptable value of 0.7. In addition, the AVE value exceeded the recommended 0.50 criterion, which ultimately confirmed the necessary reliability and convergence validity. Fornell and Larcker (1981) suggested using AVE to measure discriminant validity. **Table 4** shows that the square root of the AVE for each structure (highlighted in bold on the diagonal) is higher than the correlation between any pair of different structures, providing evidence of discriminant validity

Table 3. Fit indices for structural equation model variables.

Variables	X^2/df	GFI	RMSEA	CFI	NFI	NNFI
	<5	**>0.8**	**<0.10**	**>0.8**	**>0.8**	**>0.8**
Learning organization	1.710	0.911	0.036	0.959	0.907	0.956
Knowledge management practice	1.209	0.966	0.020	0.994	0.968	0.993
Innovation Capability	4.334	0.825	0.078	0.897	0.871	0.886
Sustainable organizational performance	2.652	0.943	0.055	0.954	0.928	0.945

5.2. Hypothesis testing

AMOS23 was used to establish the structural equation model with Learning organization as the independent variable Knowledge management practice, Innovation Capability as the mediator variable and sustainable organizational performance as the Dependent variable of structural equation modelling to explore the relationship between the variables, the following is the specific testing process and results:

Table 4. Path coefficients and significance tests for structural equation model.

Effect type	Path relationship	Estimate	S. E	*T*	*P*	Std. Estimate
Direct effect	LO → KMP	0.785	0.068	11.594	<0.001	0.846
Direct effect	LO → IC	0.405	0.065	6.233	<0.001	0.304
Indirect effect	KMP → SOP	0.541	0.127	4.262	<0.001	0.610
Indirect effect	IC → SOP	0.143	0.026	5.504	<0.001	0.232
Direct effect	LO → SOP	0.364	0.109	3.342	<0.001	0.443

The **Table 4** and **Figure 2** demonstrates the relationship between the paths, as can be seen: there is a significant positive relationship between Learning organization on Knowledge management practice (β = 0.846, p < 0.05), so hypothesis 1 is valid; there is a significant positive relationship between Learning organization on Innovation Capability there is a significant positive relationship (β = 0.304, p < 0.05); Knowledge management practice there is a significant positive relationship on sustainable organizational performance (β = 0.61, p < 0.05), therefore Hypothesis 2 is valid; Innovation Capability has a significant positive relationship on sustainable organizational performance (β = 0.232, p < 0.05); Learning organization has a significant positive relationship on sustainable organizational performance there is a significant positive relationship (β = 0.443, p < 0.05), so hypothesis 3 is valid. The self-help method (Bootstrapping) was used to test for mediating effects. Bootstrapping

is a statistical resampling technique that can be used to estimate the distribution of a sample statistic. In mediation effect analysis, it obtains the precision and confidence interval of the estimate by repeatedly sampling and calculating the mediation effect. In this study, the number of samples is set to 5000 times with upper and lower 95% confidence intervals, and the following are the specific test results.

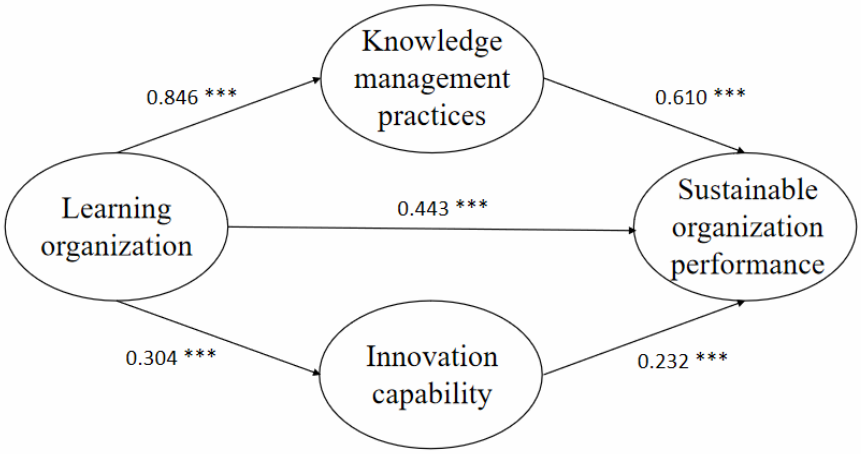

Figure 2. Hypothesis testing.

Table 5. Test for mediating effects.

Paths	Parameter	Estimate	Lower	Upper	*P*
LO → KMP → SOP	Indirect effect	0.424	0.203	0.844	0.001
	Direct effect	0.364	−0.04	0.652	0.076
	Aggregate effect	0.788	0.671	0.936	0.001
	Intermediary effect	0.462	−0.052	0.749	0.076
LO → IC→ SOP	Indirect effect	0.058	0.034	0.087	0.001
	Direct effect	0.364	−0.04	0.652	0.076
	Aggregate effect	0.422	0.016	0.712	0.045
	Intermediary effect	0.863	0.315	0.954	0.031

As show in **Table 5**, the path relationship with Learning organization as the independent variable, knowledge management practice as the mediator variable and sustainable organizational performance as the dependent variable, firstly, Learning_ organization has a significant indirect effect ($a \times b$) on sustainable organizational performance ($\beta = 0.424$, $P = 0.001$); secondly, Learning organization has a significant direct effect (c) on sustainable organizational performance direct effect (c) was not significant ($\beta = 0.364$, $p = 0.076$); third, the direct and indirect effects worked in the same direction ($a \times b \times c > 0$); therefore, it was judged to be a complementary type of full mediation, i.e., the effect of Learning organization on sustainable organizational performance will be fully mediated by Knowledge management practice, so hypothesis 4 is valid.

In the path relationship with Learning organization as the independent variable, Innovation Capability as the mediator variable and sustainable organizational performance as the dependent variable, first, Learning organization has a significant

effect on sustainable organizational performance indirect effect ($a \times b$) is significant (β = 0.058, P = 0.001) Secondly, the direct effect of Learning organization on sustainable organizational performance (c) is not significant (β = 0.364, p = 0.076); thirdly, the direct and indirect effects work in the same direction ($a \times b \times c > 0$) Therefore, it is judged to be a complementary type of full mediation, i.e., the Learning organization on sustainable organizational performance effect will be fully mediated by Innovation Capability, therefore hypothesis 5 is valid.

5.3. Interview analysis

Selected 20 managers of listed IT companies as respondents, they all think a learning organization is an entity that continuously evolves by fostering a culture where the seven aspects (CL, ID, TL, ES, EP, SC, SL) are embedded in every aspect of its operations. It encourages both individuals and teams to grow through shared knowledge and experiences, ultimately driving innovation adaptability and sustainable organizational performance. In the realm of knowledge creation within an IT company, fostering an environment where new ideas and innovations can emerge is crucial. As IT company leaders and managers focusing on improving environmental performance, integrating sustainable practices into your operations is crucial. Here are several practices an IT company manager might adopt to ensure learning organization, knowledge management, innovation capability and sustainable organizational performance have an effect on each other. The result is shown follow **Table 6**.

Table 6. The statistics of interviewees' keywords.

Variable related	Variable	NO of interview	Keyword	Percentage of agree
learning organizations (Dependent variable)	Connected systems	19	1. ERP Systems Integrated with Financial and HR Tools	95%
		18	2. Integration with Performance Management and Learning Management Systems	90%
		17	3. CI/CD Pipelines Integrated with Version Control Systems	85%
	Strategic leadership	19	1. Adaptive leadership	95%
		18	2. Visionary Leadership	90%
		17	3. Transformational Leadership	85%
	Empowerment	18	1. External learning opportunities	90%
		17	2. Dedicated learning time	85%
		16	3. Autonomy in Learning Choices	80%
	Inquiry & Dialogue	20	1. Hold Regular Team Meetings and Retrospectives	100%
		20	2. Transparent Communication Channels	100%
		18	3. Anonymous Feedback Channels	90%
	Team learning	18	1. knowledge management system	90%
		17	2. Collaborative Learning Culture	85%
		16	3. Continuous Learning Initiatives	80%
	E m bedded systems	17	1. Collaborative Learning Environments	85%
		16	2. E m bedded AI-driven (learning) systems	80%
		16	3. Performance Tracking and Skill Development,	80%
	Continuous learning	18	1. Mentor Program	90%
		18	2. Access to Online Learning Platforms	90%
		16	3. Ongoing Training Programs	80%

Table 6. (*Continued*).

Variable related	Variable	NO of interview	Keyword	Percentage of agree
knowledge management practices (Mediator variable)	Knowledge Application	20	1. Knowledge-Driven Product Design	100%
		20	2. Customer Knowledge Application	100%
		20	3.: Regularly update t Employ	100%
	Knowledge Creation	18	1. research and development labs	90%
		18	2. Employee Rotation Programs	90%
		18	3. Reflective Practices	90%
	Knowledge Transfer	20	1. After-Action Reviews	100%
		18	2. Mentoring and Coaching Programs	90%
		16	3. Internal Workshops and Training Sessions.	80%
	Knowledge Storage	18	1. Cloud Storage Solutions	90%
		17	2. Database Management:	85%
		16	3. Digital Knowledge Bases	80%
Innovation capability (Mediator variable)	Process Innovation	20	1.Business Process Management Software (BPMS)	100%
		20	2. Training and Development	100%
		18	3. Lean Methodologies	90%
	Behavior Innovation	18	1. Cultural Change Initiatives	90%
		18	2. Diversity and Inclusion Programs	90%
		17	3. Employee Empowerment Programs	85%
	Technological Innovation	18	1. Technology Scouting Teams	90%
		18	2. Advanced Prototyping Tools	90%
		16	3.Partnerships with Tech Startups and Academia	80%
	Production Innovation	20	1.Prototyping and Rapid Testing	100%
		20	2. Open Innovation Platforms	100%
		19	3. Technology Scouting	95%
	Market Innovation	20	1. Customer Insight Gathering	100%
		20	3. Blue Ocean Strategy	100%
		17	5.Digital Transformation Initiatives	85%
Sustainable organizational performance (Independent variable)	Environmental performance	18	1. Green IT Policies	90%
		18	2. Sustainable Sourcing	90%
		17	3. Renewable Energy Investments	85%
	Economic performance	20	1. Innovation Investment	100%
		20	2. Financial Planning and Analysis	100%
		20	3. Employee Training and Development	100%
	Social performance	19	1.Health and Wellness Programs	95%
		18	2. Ethical Business Practices	90%
		18	3. Sustainable Practices	90%

6. Discussion

With the rise of the knowledge-based economy, organizations have increasingly focused on enhancing learning capabilities and knowledge exchange to maintain competitiveness in fast-paced industries like IT (Yang et al., 2004). In this context, the integration of learning organization principles has gained significant attention as a means to promote long-term sustainability and performance. The findings of this study

underscore the critical role of learning organizations in driving sustainable organizational performance, particularly through the mediating effects of knowledge management practices and innovation capabilities.

The results reveal that learning organizations significantly enhance both knowledge management and innovation capabilities, which are essential for fostering adaptability and resilience in rapidly changing markets. Knowledge management, by facilitating the systematic acquisition, dissemination, and application of knowledge, strengthens an organization's ability to respond to market demands and technological changes (Shea et al., 2023). Furthermore, innovation capability, defined as the organization's ability to generate and integrate new ideas, plays a crucial role in sustaining competitiveness by enabling firms to innovate continuously and adapt to evolving customer needs (Cassia et al., 2024).

This paper demonstrates that learning organizations contribute to sustainable performance not only by enhancing operational efficiency through knowledge management but also by fostering innovation at both the product and process levels. The study's findings support prior research emphasizing the importance of organizational learning in promoting innovation and long-term sustainability (Teece et al., 1997). Moreover, the results reveal that knowledge management practices mediate the relationship between learning organizations and sustainable performance, reinforcing the argument that knowledge is a vital resource for organizational competitiveness (Grant, 1996).

Additionally, this research highlights the mediating role of innovation capability, showing that learning organizations enhance sustainable performance by fostering an environment conducive to both exploration and exploitation of new opportunities. The ability to integrate external knowledge and apply it effectively within the organization is a key factor in sustaining long-term growth, as supported by Absorptive Capacity Theory (Cohen and Levinthal, 1990). These findings suggest that innovation capability not only improves immediate operational outcomes but also contributes to the organization's strategic adaptability and resilience in the face of future challenges.

Overall, this study extends the understanding of how learning organizations, through effective knowledge management and innovation capabilities, contribute to sustainable performance. It emphasizes that while learning organizations build the foundation for knowledge management, the capacity for innovation is crucial for translating this knowledge into competitive advantages. Future research could further explore the nuances of these relationships, particularly in other sectors where rapid technological advancement and market shifts are prominent.

By positioning learning organizations as a key driver of both knowledge management and innovation, this research provides valuable insights into the mechanisms through which organizations can achieve long-term sustainability and maintain a competitive edge in the global IT sector.

7. Conclusions

The conceptual model and research hypothesis of quantitative research were further verified through qualitative analysis. This study combines quantitative research with qualitative research scientifically and effectively. Each hypothesis was validated

based on the indicators of the relevant data that were analyzed. The result is shown in **Figure 3**.

This study demonstrates the significant impact of learning organizations on sustainable organizational performance, particularly through the mediating roles of knowledge management practices and innovation capability. The research conducted on public IT companies in China highlights the essential role that learning organizations play in driving long-term success in a rapidly evolving industry. The findings indicate that knowledge management practices and innovation capability are critical factors that bridge the relationship between learning organization principles and sustainable performance.

The empirical results, supported by structural equation modeling (SEM), reveal that learning organizations have a direct, positive effect on both knowledge management practices and innovation capability, with β = 0.846 and β = 0.304, respectively. These practices, in turn, positively influence sustainable organizational performance (β = 0.610 for knowledge management practices and β = 0.232 for innovation capability). The study underscores that knowledge management practices serve as a more dominant mediator than innovation capability in the relationship between learning organizations and sustainable performance.

Additionally, the conceptual model provided (**Figure 3**) integrates various dimensions of learning organization practices, such as continuous learning, inquiry and dialogue, and embedded systems, with their influence on knowledge management, innovation, and sustainable outcomes. The results suggest that by fostering a culture of learning, continuous improvement, and knowledge sharing, organizations can enhance their ability to innovate and remain resilient in the face of market challenges.

Future research should further explore the subdimensions of learning organizations and examine other potential mediators or moderators in different industry contexts. By addressing the limitations of this study, future scholars can build on the foundations presented here to expand the understanding of how learning organizations contribute to long-term sustainability and competitive advantage.

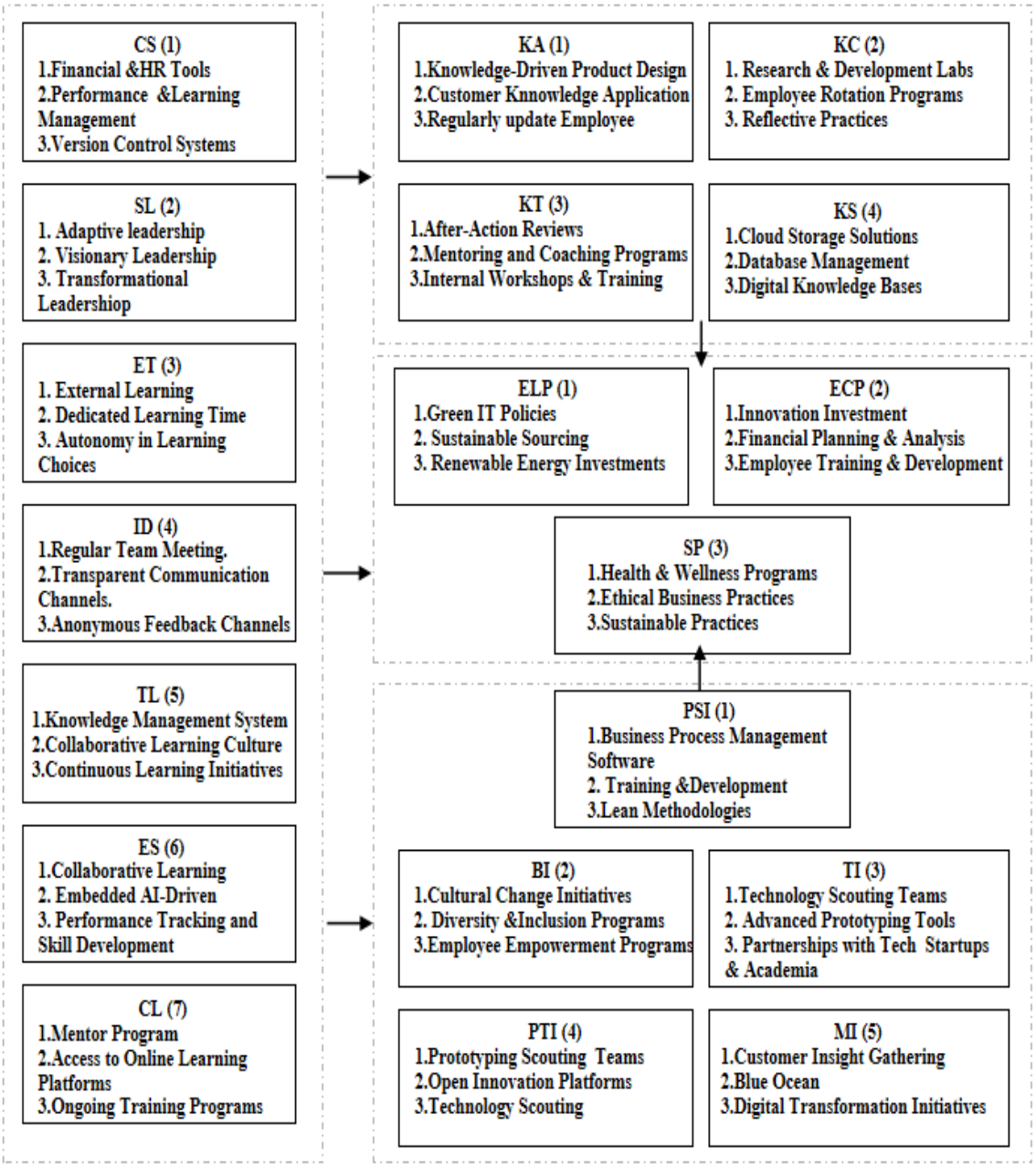

Figure 3. The model of learning organization impacts sustainable organizational performance in Chinese public IT companies.

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