



# Moderating effect of knowledge entrepreneurship in the relationship between knowledge management process and entrepreneurial success

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## ABSTRACT

This study explores the moderating effect of knowledge entrepreneurship (KNE) on the relationship between knowledge management process subsystems (KMPS) and entrepreneurial success (ENS) within China's information technology (IT) industry, thus elucidating the intricate dynamics of knowledge management in this rapidly evolving IT sector and offering a novel perspective on KNE's role. Employing a convenient sampling technique and cross-sectional design, data are collected through a self-administered questionnaire from professionals in the field and analyzed using structural equation modeling. The findings reveal that knowledge acquisition exerts a positive and significant impact on ENS, paralleled by the similarly positive and substantial influence of knowledge conversion. In addition, both knowledge preservation and utilization have beneficial and considerable impacts on ENS, highlighting the multifaceted nature of knowledge management processes (KMP). Notably, KNE significantly enhances the effect of the four KMPS dimensions on ENS. Overall, this research not only substantially contributes to the literature, particularly by examining KNE's moderating role in the interaction between KMPS and ENS, but also provides a comprehensive analysis of the symbiotic relationship between these factors. It expands the research landscape by providing insights into the complex mechanisms through which knowledge management and entrepreneurship interact within the IT sector. Furthermore, the findings offer practical relevance to managers and policymakers, underscoring the critical importance of effective knowledge management practices in fostering ENS. Finally, this study serves as a valuable resource for future researchers, extending research horizons and understanding how knowledge-driven strategies can be effectively leveraged for business success in the dynamic and rapidly evolving IT industry.

## Introduction

As global digital transformation progresses, the information technology (IT) industry is playing an increasingly significant role in various economies. For instance, in China, the rapid development of the IT sector has profoundly affected national economic growth, innovation capacity, and corporate competitiveness. Against this backdrop, knowledge management has emerged as a key factor contributing to the success of IT enterprises. Given the highly competitive and constantly evolving technological environment, effectively managing and leveraging organizational knowledge resources is crucial for enhancing innovation capabilities and achieving entrepreneurial success (ENS). However, despite the extensive theoretical discussions on knowledge management, in-depth empirical research on the role of knowledge entrepreneurship (KNE) within the knowledge management process (KMP), especially in the context of ENS, remains limited. Addressing this gap, this study explores the moderating role of KNE in the relationship

between KMP subsystems (KMPS) and ENS in China's IT industry.

Entrepreneurs recognize ENS as a critical factor (Akhtar et al., 2023; Ben Salem, 2023; Gambirage et al., 2023; Kumar et al., 2023; Ladnar et al., 2023; Muafi & Hadi, 2023; Radić et al., 2020; Ruiz & Kayahan, 2021; Sudarnice et al., 2023; Yousafzai et al., 2019; H. Zhang & Aumeboonsuke, 2023). One of the most prominent manifestations of ENS is knowledge (Aladejebi, 2018). However, in the context of China's IT industry, there is a discernible challenge in achieving and sustaining ENS. The industry faces unique challenges such as intense global competition, rapid technological shifts, and the necessity for ongoing innovation. These factors contribute to difficulties in maintaining consistent ENS, a critical issue that this study aims to address. Specifically, this research explores how KMPS and KNE can enhance ENS, particularly in the dynamic environment of China's IT industry. However, such ENS phenomena are usually explained through the implementation of KMPS (Babu et al., 2020). Further, despite the recognized importance of KMPS in fostering ENS, a theoretical gap remains in

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understanding the underlying mechanisms, particularly in the high-tech sector. We bridge this gap in the knowledge-based view (KBV) theory by empirically testing its application in a context where knowledge management and entrepreneurship intersect. Nonetheless, a comprehensive plan for making timely access to relevant KMPS is important, as noted by [García-Álvarez et al. \(2018\)](#). Our primary motivation stems from the need to understand the nuanced relationship between KMPS and ENS in the context of China's rapidly developing IT sector. Despite the vast research on knowledge management and ENS, few studies explore KNE's role as a moderator in this relationship, especially in emerging markets like China. Meanwhile, we investigate how KNE can influence the effectiveness of KMPS in enhancing ENS, thereby providing valuable insights for both academics and practitioners in the field of knowledge management and entrepreneurship.

Up-to-date knowledge is a great asset for ENS because it boosts the competitiveness of businesses. [Pouresmaeili et al. \(2018\)](#) also highlight the importance of augmenting KMPS to increase the ENS. Other studies also note that KMPS consistently strengthen KMP ([Sayyadi, 2019](#)). Drawing on KBV, [Grant and Phene \(2022\)](#) argue that this means that any company can take the lead, compete, and gain leverage in the market if it effectively and efficiently uses and implants the knowledge. KBV indicates that KMPS, which includes the procedures for knowledge transformation, acquiring, development, preservation, distribution, and usage, is important for obtaining a competitive edge and ENS ([Shujahat et al., 2019](#)). However, the impact of KMPS on ENS could be influenced by entrepreneurial characteristics and approaches. Extant research also suggests a dynamic interplay between knowledge management and entrepreneurial activities. Yet, a notable gap remains in empirical studies examining this interaction, especially in the rapidly evolving IT sector of emerging markets like China. We introduce KNE as a moderator in our study to explore how entrepreneurial attributes can potentially enhance or modify the effectiveness of KMPS, offering a more comprehensive understanding of these relationships in a specific industrial context. As the health of an enterprise's entrepreneurial tilt depends on the depth of its KMP implementation, its implementation and incentive significance have been recognized across diverse sectors ([Latif et al., 2020](#)).

Equally, KMPS is a hallmark of any successful business. In the same vein, KNE is its outward manifestation for ENS ([McDonald, 2002](#)). Despite the diverse potential moderators, KNE was selected due to its distinctive role in the IT sector. KNE encapsulates the entrepreneurial dynamics in knowledge management, a critical element in technology-centric environments where innovation and adaptability are essential. This selection is rooted in the belief that entrepreneurial skills and attitudes are key in leveraging knowledge management for competitive success, especially in a sector characterized by rapid technological evolution. The term "KNE" was coined to identify the contributions of entrepreneurs to the pipeline process ([Landström & Harirchi, 2018](#)). There are four components to environmental literacy, as outlined by [McDonald \(2002\)](#): awareness of environmental concerns, care in undertaking responsibilities, enthusiasm for trying novel approaches, and willingness to take calculated risks. Meanwhile, when it comes to innovation, business owners primarily work together along these four axes. An organization's innovative potential is also linked to its propensity to value new information, and use it to address challenges or seize opportunities ([McDonald, 2002](#)). Moreover, [Fernandes et al. \(2017\)](#) reveal several factors which influence KNE, including capability detection, entrepreneurship experience, and investment experience. Consequently, an entrepreneurial understanding of KNE is essential for comprehending the conditions under which a business is either encouraged or discouraged, as it changes its perspective on the importance of education and whether values such as inventiveness, competitiveness, and entrepreneurship are accepted ([Hayter, 2013](#)). When the entrepreneur has proper knowledge, then KMPS also increases, which enhances ENS.

In summary, several research gaps remain. For example, extant

research has only concentrated on KMPS styles and how they influence the performance of an organization or a firm ([Nguyen et al., 2021](#)), and workplace creativity ([Cai et al., 2019](#)). Meanwhile, the present study contributes to the literature by examining the implication of KMP for ENS. Moreover, research has mostly concentrated on the direct effects of KMPS on ENS. While KNE directly affects entrepreneurs, little attention has been paid to its indirect effect. Additionally, studies present inconsistent findings on the relationships between KMPS, KNE, and ENS. Next, extant literature has focused more on western countries, with few paying attention to developing ones. Despite being the world's largest developing country, China has had little research on the interactions between KMPS, KNE, and ENS. Moreover, the Chinese IT industry has played an important role in economic growth and employment creation in China. Yet, surprisingly, China lags behind in IT sector development compared with other countries. Various studies also show that the knowledge process plays an important role in increasing ENS. Next, while some studies have examined the role of knowledge management in the entrepreneurial process ([Chang et al., 2025](#)), research on how KNE influences the KMP and its specific moderating effects on ENS remains relatively scarce. Addressing this gap, this study investigates the moderating effect of KNE in the relationship between KMPS and ENS in the Chinese IT industry. Moreover, the literature primarily focuses on single dimensions of knowledge management, such as knowledge acquisition (KA) or transformation ([Idrees et al., 2023](#)), with few studies exploring the interactive effects of KNE across various knowledge management dimensions. By comparison, this study examines the moderating role of KNE in KA, transformation, knowledge storage (KST), and utilization, offering new perspectives and theoretical foundations for future research.

Overall, our main research objectives can be summarized as follows: (1) examine how different subsystems of the KMP—KA, transformation, KST, and utilization—affect ENS; (2) Analyze how KNE moderates the relationship between these knowledge management dimensions and ENS; and (3) Provide theoretical and practical guidance on how effective knowledge management practices can enhance ENS. Our findings can provide valuable insights for scholars and highlight future research directions. Moreover, the research can help managers and policy makers to better understand the importance of KMPS for increasing ENS, as well as the positive moderating role of KNE in this relationship.

The remainder of this article proceeds as follows: Section Two reviews the relevant literature, analyzing the theoretical relationships among knowledge management, KNE, and ENS, while identifying gaps in current research. Section Three provides a detailed description of the research design and methodology, including data collection and analysis methods. Section Four presents the research findings, and discusses the moderating role of KNE in the relationship between KMPS and ENS. Finally, Section Five summarizes the main findings of the study, and offers theoretical and practical implications.

## Literature review

### Theoretical foundation

According to KBV, knowledge is a critical organizational resource. It is not just a tactical asset but a strategic one, essential for value creation, performance enhancement, growth, and success in businesses ([Edi & Hidayah, 2022](#); [Hamid et al., 2024](#); [Pamucar et al., 2024](#); [Richey & Klein, 2014](#); [Zhang & Aumeboonsuke, 2023](#)). KMPS are vital in leveraging this strategic value ([Massa et al., 2023](#); [Gupta et al., 2019](#)). The implementation of KMPS aims to bolster a company's learning capacity, enriching both individual experience and organizational human capital. This diversification of knowledge capital enhances its utility and application ([Dahiyat et al., 2023](#); [Musa & Fontana, 2016](#)).

Expanding on the KBV, researchers emphasize the significance of practices like gathering, evaluating, distributing, and publishing daily operational knowledge. This shift from mere knowledge apprehension

to its active application underscores the role of management in innovatively combining existing knowledge to forge new solutions (Nickerson & Zenger, 2004). The effective and efficient implementation of KMPS is crucial for utilizing “knowledge-based resources,” thus improving overall organizational capacities and efficiencies (von Krogh & Grand, 2002; Hesamamiri et al., 2015; Leal-Rodríguez et al., 2013; Miles, 2012).

To further enrich this discourse, examining how knowledge management practices are adapted in diverse cultural and industrial contexts, particularly in the Chinese IT industry, can provide valuable insights. This could involve analyzing theoretical models and case studies, highlighting the unique challenges and approaches in Eastern versus Western corporate cultures, thus offering a more global perspective on KBV.

## ENS

ENS encompasses diverse financial and non-financial factors. It is often equated with business performance, where entrepreneurial ventures and success are viewed synonymously (Hogarth & Karelaia, 2012). Researchers have noted gender differences in defining success, with men often associating it with recognition and women with personal goal achievement (Burger-Helmchen, 2008). The broad scope of ENS is instrumental for shaping future businesses and influencing policy (Fried & Tauer, 2009). Further, individual willpower plays a crucial role in resource utilization and reducing the costs associated with business failure (Caliendo & Kritikos, 2008).

While ENS is closely tied to economic and financial aspects (Chang & Xu, 2023; Zhou et al., 2019), it also encompasses broader dimensions like innovation capacity, market share, and customer satisfaction. These elements contribute to a comprehensive understanding of ENS beyond mere financial metrics. For instance, the resilience and perseverance to sustain and grow in the market are key indicators of ENS (Fisher et al., 2014). Alstete (2008) and Orlandi (2017) suggest that wealth creation, though significant, is not the sole measure of ENS. Rather, social impact and value creation are increasingly recognized as critical components of entrepreneurial achievement (Austin et al., 2012; Edelman et al., 2008).

The diverse perspectives on ENS extend to entrepreneurial opportunities, growth potential, and leadership styles. Shane (2010) highlights the importance of understanding the mechanisms of opportunity identification and exploitation in entrepreneurship. Mitchelmore and Rowley (2013) and Carsrud et al. (2018) link entrepreneurial behaviors and opportunities to overall success, emphasizing the importance of market knowledge, creativity, and growth potential. These factors, along with effective leadership, shape the trajectory of entrepreneurial ventures and contribute to their success.

## KMPS

Knowledge, considered as a business's most important asset, spans raw materials, products, services, data, and human intellect. Drucker (2014) and Hasan and Zhou (2015) emphasize that these elements form the core of knowledge enterprises. KMPS, identified by Jain (2007) as methods for systematically producing, archiving, repurposing, and disseminating tacit and explicit information, play a critical role in leveraging these knowledge assets for explicit objectives. Masa'deh et al. (2019) highlight the significance of knowledge distribution in boosting productivity.

Leaders, through knowledge management enablers, align organizational knowledge management behaviors with effective strategies, policies, and opportunities for better learning outcomes (Yeh et al., 2006). Knowledge management metrics, as discussed by Chin Wei et al. (2009), assess knowledge impact on business, aiding strategic decision-making. Contemporary knowledge sharing (KS) practices encourage innovative thinking (Du Plessis, 2007). KMPS, integrating KA, KST, and application (KAPP), are methods for generating, disseminating, absorbing, and

applying knowledge (Sadeghi & Rad, 2018; Feroz et al., 2022; Sousa & Rocha, 2019; Chou, 2005; Asoh & Belardo, 2007).

Expanding on this, the influence of organizational culture on KMPS, particularly in terms of KS, is profound. A culture that promotes the free flow of ideas and innovation is vital (Russo et al., 2023; Wang et al., 2014; Obeidat et al., 2016). This expanded view of KMPS includes the role of KS within the organizational culture, fostering an environment where knowledge is not just managed but actively shared and creatively applied. The knowledge-creating company model by Bratianu and Orzea (2010), utilizing Polanyi's “tacit knowledge” and the SECI approach, exemplifies the integration of these processes.

## KNE

The concept of KNE, distinguishing itself from traditional definitions of entrepreneurship, emphasizes the primacy of knowledge production and sharing over financial gain Ossai and Iwegbu (2012); Izzrech et al. (2013). McKenzie (2008) and Oakley, 2014 define it as the capacity to employ varied methods for tasks and identify game-changing ideas. This innovative approach sees a paradigm shift in entrepreneurship, where knowledge exploration (KE) becomes the core.

McDonald (2002) and Coulson-Thomas (2012) argue that a rise in KE mindsets leads to greater innovation and improved organizational performance, differentiating knowledge-based opportunities from traditional resource-based ones. Skrzyszewski (2006) further elaborates that knowledge entrepreneurs excel in applying skills to intangible assets, creating value and opportunities. The author underscores the necessity for entrepreneurs to be more knowledgeable in their field than their clients or employers, focusing on the practical application of knowledge.

Senges (2007) builds upon this, proposing elements that influence KE competency. Meanwhile, Mitterle (2023) emphasizes the importance of entrepreneurship education in developing these competencies. This education, shaped by political and economic changes, plays a pivotal role in fostering an entrepreneurial ecosystem.

Expanding on these ideas, KNE's role varies across different organizational types. In startups, KNE often drives rapid innovation and adaptation. Meanwhile, in established firms, it can lead to sustained growth and transformation. Knowledge entrepreneurs in these settings must adeptly identify and leverage new knowledge, pushing the boundaries of innovation and organizational change.

Furthermore, Chou (2005) and Unger et al. (2011) explore how entrepreneurial activities like scanning, opportunity selection, strategy development, and leadership relate to entrepreneurial knowledge. Anderson and Miller (2003) link this to the diverse aspects of human capital, emphasizing the need for both practical and theoretical knowledge for entrepreneurial awareness.

## Hypothesis development

### KMPS and ENS

KMPS are important for any business to grow in terms of intellectual capital (Hussinki et al., 2017). Intellectual capital and employee knowledge substantially affect everything about KMP (Seleim & Khalil, 2011). The main goals of most KMPS are to catch, clear, verify, and share knowledge. Mehralian et al. (2014) say that the way a business acquires knowledge shows its ability to control, establish, and get information from outside sources, as well as its path to success. Because of this, the modernization and newness of existing knowledge show how important KMPS is to the success and improvement of human resources.

In addition to this, recent studies have emphasized the direct impact of KMPS on ENS, illustrating how effective knowledge management can lead to better decision-making, innovation, and ultimately, business growth.

Entrepreneurs are usually linked to business growth and success (Zorn & Taylor, 2004). This is backed up by the fact that the

entrepreneur makes the decisions about how to grow in the market (Baumann-Pauly et al., 2016). Hence, for some entrepreneurs, being innovative is the most important trait (Drucker, 2014). Entrepreneurs cannot just rely on their ability to make decisions; expertise and abilities are the most crucial components of progress and achievement (Mazzarol et al., 2010).

The literature generally acknowledges KMP's importance in promoting enterprise innovation and decision-making. However, some controversies remain regarding the specific mechanisms by which it affects ENS. Some studies suggest that the KA method directly influences an enterprise's ability to control external information. However, its specific impact on ENS has not been fully quantified. Meanwhile, although research supports the role of knowledge management practices in promoting decision-making and innovation, relatively few studies examine the independent roles of subsystems such as knowledge protection and transformation, and how they interact with entrepreneurial traits such as innovation and risk-taking. Accordingly, we propose these hypotheses, each based on the role of the KMP at different levels, suggesting that each aspect of knowledge management plays an important role in enterprise success and growth.

**H1:** KA influences ENS.

**H2:** Knowledge conversion influences ENS.

**H3:** Knowledge utilization influences ENS.

**H4:** Knowledge protection influences ENS.

Next, hypothesis H5 proposes the moderating role of KNE in the relationship between KA and ENS. Innovation depends on a comprehensive understanding of knowledge. KA, as the starting point of innovation, is crucial. KA is not merely about obtaining information; it also involves a keen response to market demands and technological dynamics. Entrepreneurs, through the accumulation of education, experience, and skills, are better able to identify and acquire appropriate knowledge, thereby laying the foundation for ENS. KNE enhances entrepreneurs' innovative capacity, market insight, and adaptability, enabling them to acquire knowledge more effectively and transform it into business opportunities. Therefore, as a moderating variable, KNE can influence the efficiency and effectiveness of KA, thereby further affecting ENS.

Hypothesis H6 explores how KNE moderates the relationship between knowledge transformation and ENS. Knowledge transformation is the process of converting acquired knowledge into practical application, which is vital for innovation and enterprise success. Entrepreneurs must understand how to transform knowledge, and integrate it into business operations and strategies. KNE enhances entrepreneurs' managerial capabilities and adaptability, allowing them to transform and apply knowledge effectively and drive innovation. KNE provides the necessary "know-how," enabling entrepreneurs to integrate and utilize various types of knowledge effectively in complex environments. Therefore, by improving entrepreneurs' knowledge transformation capability, KNE moderates the role of knowledge transformation in ENS, making it more efficient and effective.

Hypothesis H7 emphasizes the moderating role of KNE in the relationship between knowledge utilization and ENS. Knowledge utilization refers to the ability to apply and leverage knowledge in daily operations. Effective knowledge utilization can enhance a firm's market responsiveness and innovation capacity, thereby promoting ENS. However, the effect of knowledge utilization often depends on how entrepreneurs integrate their personal experience, education, and skills into actual operations. KNE helps entrepreneurs better identify and exploit market opportunities, which directly influences enterprise growth and success. Thus, as a moderating variable, KNE helps entrepreneurs transform knowledge into practical business outcomes, strengthening the impact of knowledge utilization on ENS.

Hypothesis H8 explores the role of knowledge protection in ENS and emphasizes the moderating effect of KNE in this process. In today's

highly competitive business environment, knowledge protection is not only a means of preventing knowledge loss but also a key strategy for safeguarding intellectual property and maintaining competitive advantage. Entrepreneurs' skills and knowledge enable them to make informed decisions regarding knowledge protection. However, the effectiveness of knowledge protection depends on whether entrepreneurs possess sufficient knowledge and experience to understand the value of knowledge and appropriate protection methods. KNE improves entrepreneurs' knowledge management and strategic thinking capabilities, enabling them to better identify and protect critical knowledge assets, thereby creating long-term competitive advantages for the enterprise. Therefore, KNE plays an important moderating role in the relationship between knowledge protection and ENS, enhancing the effectiveness of knowledge protection.

In recent years, theoretical advances in knowledge management have emphasized the dynamic nature of knowledge and the importance of innovation, especially in rapidly changing industries such as the IT industry. Research indicates that entrepreneurs' decision-making ability is directly related to firm growth. Other studies highlight the decisive role of entrepreneurial innovativeness in market competition. These theoretical developments offer some support to hypotheses H1 to H4. In particular, the hypotheses concerning knowledge protection and utilization align with the increasing emphasis on information security and knowledge capital protection in modern enterprises, indicating that in the age of IT and digitalization, knowledge protection is as critical as innovation. Therefore, by establishing these hypotheses, this study explores how subsystems of knowledge management interact with entrepreneurs' innovative capabilities and market decision-making, further validating the deep connection between knowledge management theory and ENS.

These hypotheses are grounded in the belief that different aspects of knowledge management, from acquisition to protection, play a distinct role in shaping entrepreneurial outcomes, and their interactions with entrepreneurial qualities like innovation and risk-taking are crucial for understanding the full impact on business success.

#### *KNE as a moderator*

Creations that utilize information are usually characterized depending on their commercial potential (Drucker, 2014). While numerous entrepreneurs are interested in learning how to be successful and make money, for knowledge base innovation to work, one would need to know everything there is to know about innovation, entrepreneurship, and knowledge itself. As such, KE comprises education, skills, and experience (Donnellon et al., 2014). Instead of focusing on certain types of knowledge, the entrepreneur should understand how the different types of knowledge fit together (Iversen et al., 2009). In this context, Argyris and Ransbotham (2016) propose "KNE" as a fresh approach to project management which uses KMP inside the technological fields of adaptability and managerial abilities. Researchers are also examining intricate systems of socioeconomic and institutional institutions to create new forms of cutting-edge technology that can help knowledge entrepreneurs (Christensen, 2004).

As such, KNE may serve as a critical moderator in the relationship between KMPs and ENS, suggesting that the way entrepreneurs engage with and apply knowledge can significantly influence the outcome of KMPs. Knowledge is one of the most important things for ES. Makhbul and Hasun (2011) argue that there are many ways to learn, including through personal experience, and whether it is formal and informal. The authors explain that how an informed (educational or knowledgeable) entrepreneur can be a leader and come up with new ideas, which lets them take advantage of market opportunities. KE has an extensive potential to improve performance, and bring in customers and stakeholders based on knowledge. KE entails using "know-how" to meet customer needs, and sells their skills to make personalized help and give customers contemporary inducements (Coulson-Thomas, 2003).

Although the literature generally acknowledges the role of the KMP in business growth, research on the moderating role of KNE in this process remains limited. Some studies have highlighted the commercial potential of knowledge innovation, emphasizing that entrepreneurs' capabilities in innovation and knowledge utilization are critical to business success. However, while prior research has explored how KMP facilitates business decision-making and innovation, it has largely overlooked how entrepreneurs function within the KMP, particularly the moderating effect of KNE. Other studies have provided a new perspective on the definition of KNE, stressing its adaptability and managerial capacity in technical domains. This study's hypotheses respond critically to these gaps by proposing that KNE plays an important moderating role in the interaction between knowledge management subsystems and ENS, thereby addressing a key deficiency in extant research. Specifically, we propose four hypotheses, suggesting that KNE significantly moderates the relationships between KA, knowledge transformation, knowledge utilization, and knowledge protection and ENS. Through these hypotheses, the study emphasizes how key elements of KNE—such as education, skills, and experience—affect the effectiveness of the KMP, thereby influencing a firm's innovation capacity and market competitiveness.

**H5:** KNE moderates the relationship between KA and ENS.

**H6:** KNE moderates the relationship between knowledge conversion and ENS.

**H7:** KNE moderates the relationship between knowledge utilization and ENS.

**H8:** KNE moderates the relationship between knowledge protection and ENS.

Hypothesis H1 proposes that KA affects ENS. KA is the starting point of the enterprise KMP, involving the collection of external information, market data, and industry dynamics. Through effective KA, enterprises can grasp external resources, and enhance their market competitiveness and innovation capability. This ability directly affects the enterprise's decision-making process and strategic formulation, thereby promoting business success. KA is crucial to KMP because it provides the foundation for enterprise innovation and growth. Therefore, KA not only helps enterprises identify market opportunities but also lays a solid knowledge foundation for their ENS. Thus, enterprises can improve their decision-making ability and market adaptability through more effective KA, thereby promoting ENS.

Hypothesis H2 explores the impact of knowledge conversion on ENS. Knowledge conversion is the process of transforming acquired knowledge into innovative outcomes and practical applications, which is crucial to the competitiveness and innovation of enterprises. Knowledge conversion is not merely about storing and managing information but about integrating it with the actual needs of enterprises to promote the practical application of knowledge. Innovation capability is the key to ENS, while knowledge conversion is an important path to realize innovation. Entrepreneurs can, through knowledge conversion, integrate externally acquired knowledge with internal resources to promote innovation in products and services, and enhance market competitiveness. Therefore, the proposed impact of knowledge conversion on ENS in Hypothesis H2 is consistent with the theoretical argument, emphasizing how knowledge is actually used in firm operations through conversion and plays an important role in business success.

Hypothesis H3 proposes that KAPP affects ENS. KAPP is the process of effectively applying the acquired and converted knowledge into actual operations. When enterprises utilize knowledge, they can improve efficiency, optimize decision-making, and enhance customer service, all of which directly promote business growth and success. Entrepreneurs need both decision-making capabilities and the ability to apply knowledge, especially in complex and dynamic market environments. Effective KAPP helps entrepreneurs to respond quickly and seize opportunities in rapidly changing markets. This hypothesis reflects the

core role of knowledge management in improving enterprise performance, particularly emphasizing that KAPP can promote innovation, growth, and success of the enterprise.

Hypothesis H4 discusses the impact of knowledge protection on ENS. Knowledge protection is the process by which enterprises protect their intellectual property, technology, and innovation outcomes. With the continuous enhancement of enterprise innovation capability, effective means to protect knowledge are crucial for sustainable competitiveness. Entrepreneurs, through effective knowledge protection strategies, can not only maintain the technical advantages of the enterprise but also enhance market trust and brand value. ENS cannot be separated from the effective protection of enterprise knowledge assets. Hence, knowledge protection directly affects the market position and long-term development of the enterprise. Accordingly, the relationship between knowledge protection and ENS proposed in Hypothesis H4 explains why entrepreneurs should pay attention to the protection of knowledge to maintain long-term competitive advantages.

In the latest theoretical developments, KNE is regarded as an important factor in promoting innovation and enhancing enterprise competitiveness. KNE not only focuses on specific types of knowledge but emphasizes the integration and application of different knowledge types, which is closely related to the moderating roles in Hypotheses H5 to H8. In particular, the key role of knowledge innovation in the technical field supports the profound influence of KNE on innovation and ENS in the KMP. By combining these latest theoretical developments with our hypotheses, we can better understand how KNE moderates the effects of different knowledge management subsystems on ENS, thereby providing new perspectives and practical guidance for knowledge management and entrepreneurship theory.

Fig. 1 outlines the research framework.

### Research methodology

The research adopted a quantitative approach for its reliability and suitability in providing measurable and testable data for hypothesis testing, as compared to the qualitative approach (Apuke, 2017; Arghode, 2012). Specifically, a stratified random sampling technique was first used to recruit the sample. This approach can divide the target population into different subgroups according to specific criteria and randomly select samples from each subgroup. Such a design ensures the diversity and representativeness of the sample. Therefore, this method can comprehensively reflect knowledge management practices across different industries, scales, and regions, thus providing reliable data for examining the research phenomena.

Furthermore, we employed a cross-sectional research design, which is particularly effective when data are collected at a single point in time (Arghode, 2012; Berman et al., 2000). Given the developed theory and formulated hypotheses, this design was optimal for capturing the explanatory nature of the research as it allows for a comprehensive analysis of data at a specific time, providing a detailed snapshot of the variables and their interactions (Dulock, 1993).

### Survey instrument

First, an online survey questionnaire was administered through email and social media platforms to maximize the coverage of the target audience, yielding 320 valid questionnaires with a response rate of 64 %; this indicates a high level of participation from the respondents and strong representativeness of the data. The questionnaire scale has been previously validated and appropriately adjusted according to the context of the current study, ensuring its reliability of the questionnaire. SPSS and AMOS were used for data analysis.

The dependent variable, ENS, was measured using six items adopted from Falco-Walter et al. (2018). Some items included "Our company has demonstrated significant growth in profitability" and "We have successfully expanded our customer base." KMP consists of four

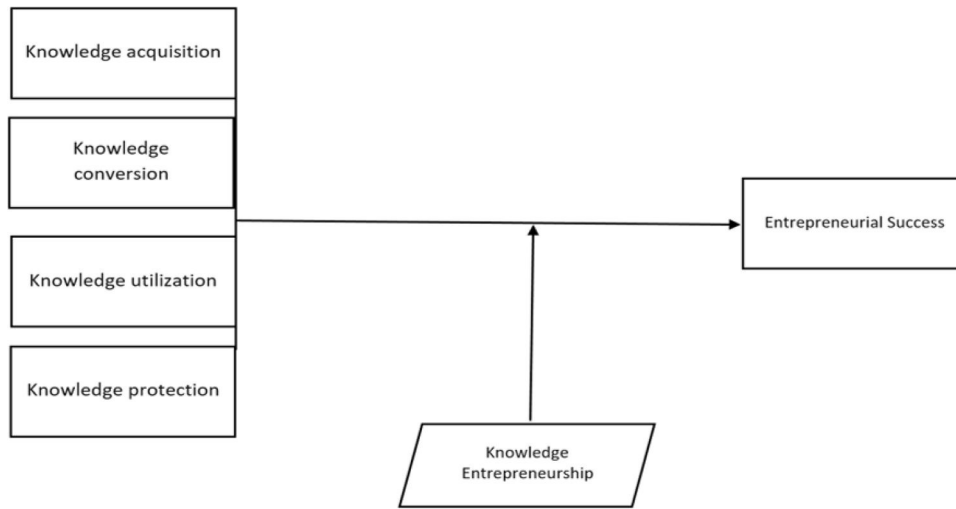


Fig. 1. Conceptual model.

dimensions, which were measured using different items. KA had 8 items, knowledge conversion had 6 items, knowledge utilization had 3 items, and knowledge protection had 10 items. Some examples of items for KA include “Our company effectively integrates new knowledge into existing operations.” An item for knowledge conversion was “We effectively transform tacit knowledge into explicit knowledge for wider use.” These dimensions were adopted from Gold et al. (2001). KNE, as a moderating variable, was measured by three items adopted from McDonald and Ho (2002). Some of these items included “Our entrepreneurial strategies are significantly influenced by our knowledge management capabilities” and “We utilize our knowledge assets to innovate new business models.” These items were measured on a five-point Likert Scale (1: strongly disagree to 5: strongly agree).

To gain a more comprehensive understanding of the moderating role of KNE in the relationship between knowledge management and ENS, interviews were also conducted with entrepreneurs and senior managers, who shared their experiences in knowledge management practices and their insights into ENS. These helped in understanding the challenges faced by different enterprises in the processes of KA, conversion, utilization, and protection, as well as how KNE influences their decision-making and innovation strategies.

SEM was adopted as the main statistical analysis method for testing the hypothesized relationships. SEM can simultaneously handle complex relationships among multiple variables, which is highly suitable for the latent variables involved in this study. AMOS was used to conduct the SEM analysis. Multiple goodness-of-fit indices, such as CFI, TLI, and root mean square error of approximation (RMSEA), were used to evaluate the overall model fit, and ensure the robustness and validity of the results.

## Findings

### Demographic analysis

Table 1 reports the participant demographics. The majority of the participants are male and between 20 and 29 years old. Moreover, the predominance of younger entrepreneurs (aged 20 to 29) in the study suggests a dynamic entrepreneurial landscape, potentially more open to adopting innovative knowledge management practices. This age group is often more tech-savvy and receptive to new ideas, which could influence the ways in which knowledge is acquired, shared, and utilized within their businesses. Furthermore, the fact that a majority of respondents possess university education indicates a well-informed participant base, which is likely to be familiar with the latest knowledge management theories and practices. This educational background might contribute to more sophisticated and effective implementation of

Table 1  
Participant demographics.

| Characteristic       | Percent |
|----------------------|---------|
| <b>Gender</b>        |         |
| Male                 | 68      |
| Female               | 32      |
| <b>Age</b>           |         |
| 20 to 29 years       | 43      |
| 30 to 39 years       | 39      |
| 40 to 49 years       | 11      |
| Above 50             | 7       |
| <b>Qualification</b> |         |
| Primary or below     | 5.5     |
| University           | 60      |
| Post-graduate        | 27.2    |
| PhD and above        | 7.3     |

knowledge management strategies, fostering environments that are conducive to innovation and growth.

### Model analysis

Using AMOS 20.0, SEM was used to evaluate the measurement model and examine the proposed relationships. The choice of AMOS 20.0 for SEM was driven by several factors. Compared with other software like Smart PLS, AMOS has robust capabilities in specifying, estimating, assessing, and presenting complex SEM models. AMOS’s advanced features, such as maximum likelihood estimation, are particularly beneficial for our study’s focus on theory testing and confirmation. It offers a more rigorous model estimation procedure, ideal for assessing the fit between the collected data and our proposed theoretical model. Unlike Smart PLS, which is more suited for exploratory models, AMOS provides a more precise testing environment for our hypothesis-driven research. This is crucial for our study’s aim to validate the relationships within the proposed model with a high degree of accuracy. Model fit in AMOS was assessed using various indices like p-value, the chi-square to degrees of freedom ratio (CMIN/DF), root mean square residual (RMR), adjusted goodness of fit index (AGFI), goodness of fit index (GFI), and RMSEA. Each of these indices plays a crucial role in validating the SEM model. The p-value assesses the probability that the model could have produced the observed data. A p-value below 0.05 generally indicates that the model is a good fit. CMIN/DF evaluates the model’s overall fit; values <3 are considered acceptable. RMR measures the average residuals; values below 0.08 suggest a good fit. AGFI and GFI both evaluate the fit of the model relative to a null model, with values above 0.90 indicating a

good fit. Lastly, RMSEA considers the model's complexity; values below 0.08 are indicative of a good fit. These indices were selected for their widespread application in SEM and their ability to provide a comprehensive assessment of how well the model fits the collected data. In summary, the cutoff values are as follows: P-Value  $< 0.05$ , CMIN/DF  $< 3$ , RMR  $< 0.08$ , AGFI and GFI  $> 0.90$ , and RMSEA  $< 0.08$ , aligning with standard model fit criteria (Hu & Bentler, 1999). These were selected due to their wide application in SEM and acceptance in academic research for providing a comprehensive assessment of model fit (Kline, 2015).

According to Table 2, the model fitness analyses results are at acceptable levels. The goodness of fit statistics showed that the overall model fit quite well to the data.

Before delving into conceptual framework, an AMOS-based confirmatory factor analysis (CFA) was performed to assess measurement model fit, followed by testing the construct reliability, convergent validity, and discriminant validity (Miller et al., 2009). Table 3 shows the standardized factor loadings, reliability, and validity measures for the final measurement model. The standardized factor loadings, all exceeding the minimum recommended value of 0.50, signify strong associations between the items and their respective constructs, indicating that our measurements accurately represent the intended variables. The reliability of each construct, as reflected in the Cronbach alpha values exceeding 0.60, assures that the constructs are consistently measured. Furthermore, the composite reliability values surpassing 0.70 further reinforce the internal consistency of the constructs. These reliability measures, alongside the validity confirmed by the AVE values exceeding 0.50, suggest that our model is not only reliable but also effectively captures the essence of the constructs we aim to study. Furthermore, all of these items were included in the subsequent analysis because they met the minimum recommended value of 0.50 factor loadings and RMSEA  $< 0.10$  (Kline & Rosenberg, 2010).

Reliability analysis is concerned with determining the degree of consistency between multiple measurements of a variable, which can be calculated using the Cronbach alpha coefficient and composite reliability (Hair et al., 2014). Some researchers (Bagozzi & Yi, 1988) have proposed that all indicators and dimensional scales should have values greater than the recommended value of 0.60. As shown in Table 3, all eight Cronbach Alpha values exceeded the recommended value of 0.60 (Bagozzi & Yi, 1988), indicating that the instrument is reliable. The use of the Cronbach alpha coefficient and composite reliability in our study served to rigorously assess the consistency and stability of the measurements. Cronbach alpha values, all exceeding 0.60, indicate a high level of internal consistency within each construct, ensuring that each item within a construct measures the same underlying concept. Similarly, the composite reliability values, surpassing 0.70, further validate the internal consistency and confirm the reliability of our constructs over multiple items. Additionally, the validation of measurement items was meticulously conducted using scales from previous studies and expert reviews. This process involved selecting items from established scales that closely align with our research constructs, followed by a thorough review by business faculty instructors and academics to ensure content validity. This rigorous approach to validating our measurement items bolsters the reliability and validity of our study's findings, contributing to the overall strength and credibility of the research. Furthermore, the composite reliability values in the same table also

exceeded 0.70, surpassing the recommended value of greater than 0.60 (Bagozzi & Yi, 1988) or 0.70 as suggested by Holmes-Smith (2006). As a result of the results of the two tests mentioned above, all research constructs in this study are deemed reliable.

Dependability is required but is an insufficient requirement for assessing the worth of a study measure on its own (Sekaran & Bougie, 2016). Hence, another factor can be used to assess a measure's quality is validity (Blumberg, 2005). The items chosen to measure the six variables were validated and re-used from prior studies. Therefore, the researchers relied on a pre-existing scale developed by other researchers in order to improve the validity of the scale. In addition, four instructors of the Business Faculty at the University of Jordan reviewed the questionnaire items. The instrument's content validity was enhanced as a result of the pre-test group's feedback. Finally, to improve the content validity of the instrument, seven academics were asked to provide feedback on the questionnaire, thereby confirming that the knowledge presented in the content of each question was pertinent to the topic under investigation.

Discriminant validity was assessed using the average variance extracted (AVE). Specifically, any extremely high correlations between constructs would indicate a problem with the model's discriminant validity. If the AVE for each construct exceeds the square correlation between that construct and all others, discriminant validity has been established (Fornell & Larcker, 1981). As shown in Table 4, all constructs' AVEs were greater than the recommended level of 0.50 (Holmes-Smith, 2001). Furthermore, discriminant validity was confirmed because the AVE values for each set of constructs exceeded their squared correlations.

### Structural model

The structural model was tested in accordance with the two-phase SEM procedure. The coefficient of determination was 0.57, suggesting that the proposed model adequately accounts for the observed variation.

The results indicate that KA, knowledge conversion, knowledge utilization, and knowledge protection have significant positive effects on ENS. The significant positive impact of KA on ENS underscores the vital role of continuous learning and information gathering in ENS, as suggested by contemporary knowledge management theories. Similarly, the notable effects of knowledge conversion, utilization, and protection highlight the comprehensive nature of knowledge management in driving business success. These findings corroborate existing research that emphasizes the multifaceted impact of KMP on organizational outcomes. The positive moderating effect of KNE between KMPS dimensions and ENS aligns with the emerging view of KNE as a catalyst in the knowledge management-success nexus. This deeper analysis not only validates our research model but also contributes to the broader discourse on the strategic importance of knowledge management in entrepreneurial ventures. Thus, all direct and moderation effects are supported. The coefficient values for these relations are noted in Fig. 2. Table 5 reports the hypotheses testing results.

### Discussion and implications

This research examined the moderating effect of KNE in the relationship between KMPS and ENS in IT companies in China. We reveal how different dimensions of KMPS significantly influence ENS, providing insights into the crucial role of knowledge management in entrepreneurial ventures, particularly in technology-driven sectors

#### (1) Hypothesis 1 - KA and ENS:

Our findings revealed that KA positively influences ENS. This aligns with Chang et al. (2012), who find that acquiring new and relevant knowledge is crucial for organizational growth. This dimension of KMPS is particularly vital in the rapidly evolving IT

**Table 2**  
Measurement model fitness indices.

|                    | p value | CMIN/DF | RMR   | AGFI  | GFI   | RMSEA |
|--------------------|---------|---------|-------|-------|-------|-------|
| Default Model      | 0.504   | 0.672   | 0.010 | 0.958 | 0.984 | 0.000 |
| Saturated Model    |         |         | 0.000 |       | 1.001 |       |
| Independence Model | 0.000   | 7.640   | 0.067 | 0.706 | 0.833 | 0.241 |

**Table 3**

Construct reliability and convergent validity.

| Constructs and Indicators    | Std. Loading | Std. Error | Square Multiple Correlation | Error Variance | Cronbach Alpha | Composite Reliability | AVE  |
|------------------------------|--------------|------------|-----------------------------|----------------|----------------|-----------------------|------|
| <b>Knowledge Acquisition</b> |              |            |                             |                | 0.914          | 0.95                  | 0.54 |
| KNA1                         | 0.679        | 0.128      | 0.443                       | 0.243          |                |                       |      |
| KNA2                         | 0.633        | 0.126      | 0.524                       | 0.265          |                |                       |      |
| KNW4                         | 0.601        | 0.113      | 0.514                       | 0.214          |                |                       |      |
| KNA 5                        | 0.611        | 0.098      | 0.401                       | 0.301          |                |                       |      |
| KNA7                         | 0.576        | 0.092      | 0.445                       | 0.215          |                |                       |      |
| KNA8                         | 0.571        | 0.099      | 0.435                       | 0.223          |                |                       |      |
| KNA9                         | 0.537        | 0.087      | 0.459                       | 0.252          |                |                       |      |
| KNA10                        | 0.691        | 0.092      | 0.444                       | 0.102          |                |                       |      |
| <b>Knowledge Conversion</b>  |              |            |                             |                | 0.856          | 0.91                  | 0.64 |
| KNC1                         | 0.801        | 0.087      | 0.398                       | 0.310          |                |                       |      |
| KNC2                         | 0.721        | 0.079      | 0.402                       | 0.301          |                |                       |      |
| KNC3                         | 0.641        | 0.081      | 0.406                       | 0.239          |                |                       |      |
| KNC4                         | 0.647        | 0.090      | 0.424                       | 0.264          |                |                       |      |
| KNC5                         | 0.726        | 0.093      | 0.425                       | 0.276          |                |                       |      |
| KNC6                         | 0.654        | 0.079      | 0.413                       | 0.277          |                |                       |      |
| <b>Knowledge Unitization</b> |              |            |                             |                | 0.882          | 0.87                  | 0.69 |
| KNU1                         | 0.711        | ***        | 0.276                       | 0.224          |                |                       |      |
| KNU3                         | 0.702        | 0.076      | 0.289                       | 0.212          |                |                       |      |
| KNU3                         | 0.668        | 0.072      | 0.292                       | 0.218          |                |                       |      |
| <b>knowledge Protection</b>  |              |            |                             |                | 0.879          | 0.96                  | 0.71 |
| KNP1                         | 0.812        | ***        | 0.357                       | 0.221          |                |                       |      |
| KNP2                         | 0.802        | 0.094      | 0.390                       | 0.211          |                |                       |      |
| KNP3                         | 0.559        | 0.092      | 0.378                       | 0.124          |                |                       |      |
| KNP4                         | 0.571        | 0.079      | 0.412                       | 0.119          |                |                       |      |
| KNP5                         | 0.787        | 0.081      | 0.426                       | 0.219          |                |                       |      |
| KNP6                         | 0.613        | 0.090      | 0.431                       | 0.156          |                |                       |      |
| KNP7                         | 0.622        | 0.083      | 0.485                       | 0.121          |                |                       |      |
| KNP8                         | 0.636        | 0.081      | 0.466                       | 0.141          |                |                       |      |
| <b>KNE</b>                   |              |            |                             |                | 0.923          | 0.85                  | 0.67 |
| KNE1                         | 0.746        | 0.078      | 0.422                       | 0.267          |                |                       |      |
| KNE2                         | 0.693        | 0.097      | 0.454                       | 0.244          |                |                       |      |
| KNE3                         | 0.626        | 0.089      | 0.451                       | 0.223          |                |                       |      |
| <b>ENS</b>                   |              |            |                             |                | 0.913          | 0.89                  | 0.60 |
| ENS1                         | 0.802        | 0.093      | 0.401                       | 0.287          |                |                       |      |
| ENS2                         | 0.761        | 0.093      | 0.389                       | 0.273          |                |                       |      |
| ENS3                         | 0.555        | 0.099      | 0.376                       | 0.212          |                |                       |      |
| ENS4                         | 0.521        | 0.095      | 0.422                       | 0.223          |                |                       |      |
| ENS6                         | 0.545        | 0.089      | 0.397                       | 0.237          |                |                       |      |

**Table 4**

Discriminant validity.

| Constructs | KNA  | KNC  | KNU  | KNP  | KNE  | ENS  |
|------------|------|------|------|------|------|------|
| <b>KNA</b> | 0.74 |      |      |      |      |      |
| <b>KNC</b> | 0.43 | 0.84 |      |      |      |      |
| <b>KNU</b> | 0.41 | 0.48 | 0.86 |      |      |      |
| <b>KNP</b> | 0.43 | 0.41 | 0.52 | 0.88 |      |      |
| <b>KNE</b> | 0.46 | 0.42 | 0.46 | 0.62 | 0.83 |      |
| <b>ENS</b> | 0.33 | 0.37 | 0.39 | 0.44 | 0.55 | 0.81 |

sector, where staying updated with the latest technological advancements is key to maintaining competitive advantage.

(2) Hypothesis 2 - Knowledge Conversion and ENS:

The significant impact of knowledge conversion on ENS in our study echoes the findings of [Gunasekera and Chong \(2018\)](#). In technology-dependent firms, converting tacit knowledge into explicit knowledge facilitates innovation and adaptability, enhancing the potential for ENS.

(3) Hypothesis 3 - Knowledge Utilization and ENS:

Our results show that effective knowledge utilization is critical for ENS, consistent with [Knockaert et al. \(2011\)](#). This underscores the need for IT companies to not only acquire and convert knowledge but also to apply it strategically to drive business outcomes.

(4) Hypothesis 4 - Knowledge Protection and ENS:

The positive relationship between knowledge protection and ENS highlights the importance of securing intellectual assets, as noted by [Grant \(2015\)](#). This is particularly relevant in the IT

sector, where proprietary knowledge and innovations form the bedrock of competitive edge.

(5) Hypothesis 5–8 - KNE as a Moderator:

The significant moderating role of KNE in enhancing the relationship between KMPS and ENS reaffirms [Coulson-Thomas's \(2004\)](#) argument about the value of entrepreneurial principles in leveraging knowledge and that KNE aids in performance enhancement. Our results demonstrate the value of entrepreneurial principles in leveraging knowledge for business success, consistent with [Sullivan's \(2000\)](#) observations on the importance of entrepreneurial understanding for long-term business survival. Clearly, this finding is pivotal in the context of IT companies, where entrepreneurial agility can effectively harness KMPS for greater business success.

Overall, our findings indicate that KMPS substantially affects ENS, consistent with previous research ([Chang et al., 2012](#); [Gunasekera & Chong, 2018](#)) which highlights the positive influence of knowledge management practices on organizational outcomes. In technology-dependent firms, KMPS could substantially enhance the likelihood of ENS, aligning with the insights of [Knockaert et al. \(2011\)](#). This underscores the ongoing importance of the KBV in elucidating the role of knowledge management in businesses, as noted by [Grant \(2015\)](#). Overall, our study supports the notion that effective utilization of knowledge resources can lead to improved organizational performance.

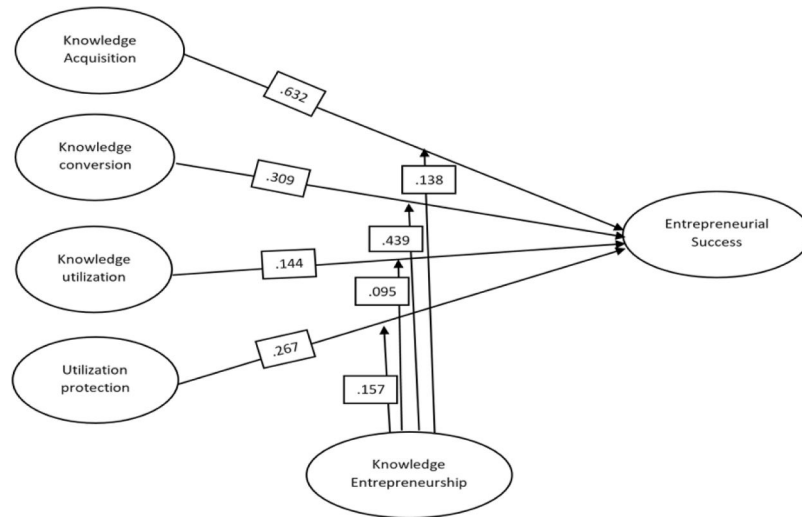


Fig. 2. Coefficients values.

Table 5

Direct and moderation effects.

|                | Beta  | Standard Error | T Statistics | P Values |           |
|----------------|-------|----------------|--------------|----------|-----------|
| KNA-> ENS      | 0.462 | 0.059          | 7.835        | 0.000    | Supported |
| KNC-> ENS      | 0.309 | 0.053          | 5.887        | 0.000    | Supported |
| KNU -> ENS     | 0.144 | 0.054          | 2.696        | 0.007    | Supported |
| KNP -> ENS     | 0.267 | 0.054          | 4.916        | 0.000    | Supported |
| KNA*KNE-> ENS  | 0.138 | 0.052          | 2.673        | 0.008    | Supported |
| KNC*KNE -> ENS | 0.439 | 0.061          | 7.249        | 0.000    | Supported |
| KNU*KNE -> ENS | 0.095 | 0.026          | 3.687        | 0.000    | Supported |
| KNP*KNE -> ENS | 0.157 | 0.045          | 3.532        | 0.001    | Supported |

### Theoretical contributions

This research contributes to the literature on knowledge management and entrepreneurship. We demonstrate the substantial effect of KMPS on ENS and positive moderating role of KNE. Further, our work validates the KBV theory's applicability in the context of modern IT companies and provides a fresh perspective on the role of *entrepreneurship in knowledge-intensive environments*.

### Practical implications

For practitioners, especially in the high-tech sector, our study highlights the importance of integrating effective knowledge management and entrepreneurial strategies to achieve business success. The insights could guide high-tech entrepreneurs in understanding the critical role of KMPS and KNE in enhancing their likelihood of success. Governmental and non-governmental entities can also benefit from these findings, as incorporating robust KMPS and entrepreneurial principles could lower the rate of unsuccessful ventures in the high-tech industry. Additionally, mentors and trainers might emphasize the importance of a managerial style that combines effective knowledge management with entrepreneurship to foster success.

In conclusion, our study not only corroborates the direct impact of KMPS on ENS but also reveals the nuanced role of KNE as a moderator, offering valuable insights for both academic research and practical applications in the field of knowledge management and entrepreneurship.

### Limitations and future research directions

First, our sample is limited to entrepreneurs in China's IT industry, which may constrain the generalizability of the research results. Future research should consider conducting similar studies in enterprises located in other regions or countries to explore the moderating roles of KMP and KNE under different cultural backgrounds, industry characteristics, and economic environments. Cross-regional or cross-national comparisons can uncover how cultural differences influence the role of KNE in promoting ENS, while also evaluating the similarities and differences in business strategies and management practices under varying market conditions. In addition, future studies could incorporate enterprises of different sizes, particularly small and medium-sized enterprises, to explore their unique needs and challenges in KNE and knowledge management practices, thereby providing a more comprehensive understanding of the multidimensional impact of KNE.

Second, this study employed a cross-sectional design, which, while providing a snapshot of current knowledge management and ENS, does not capture the dynamic relationships over time. As such, future studies should prioritize the use of longitudinal and panel data methods. These methods can help researchers track the changes in firms' knowledge management practices over time and their effects on ENS, thereby revealing long-term trends and causal relationships. Furthermore, this study mainly relied on quantitative data to test the hypotheses, supplemented by limited qualitative research. Further using qualitative research methods can offer deeper insights, especially in understanding complex phenomena and exploring variables that are not easily quantified. Therefore, future research can combine quantitative and qualitative methods in a mixed-method approach to more comprehensively examine the diversity and deeper impacts of knowledge management and KNE. Through such integrated research, more precise strategic recommendations can be provided for practical enterprises, further promoting the application and development of KNE across various industries, and ultimately, enhancing ENS.

### CRediT authorship contribution statement

**Ruixue Zhang:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Data curation.

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