



# Ambidextrous leadership: an emphasis on the mediating role of knowledge sharing and knowledge search

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## Abstract

Innovation is widely being recognized as a crucial determinant of organizations' competitive advantage. This study delves into ambidextrous leadership, encompassing two seemingly contrasting yet potentially complementary behaviors—opening and closing leadership. The aim is to elucidate how a leader can pave the way for achieving innovation among employees, and throughout the entire organization by leveraging the dual strategies of knowledge sharing and knowledge search. This research is descriptive in nature, grounded in a positivist research philosophy with an applied research orientation. The proposed research strategy involves a survey employing quantitative methods. Ambidextrous leadership characterized by both opening and closing approaches has the potential to enhance employees' innovation through knowledge sharing. Furthermore, the proposed study reveals that ambidextrous leadership encompassing Transactional and Transformational leadership styles fosters organizational innovation through knowledge search. As social information processing technology is being updated continuously, leaders' demonstration on both the opening and closing behaviors can drive innovation at both employee and organizational levels. Moreover, the mediating roles of knowledge sharing and knowledge seeking are vital to achieve these outcomes. However, the eighth hypothesis which explores the moderating influence of strategic flexibility does not yield significant results. A balanced strategy between these dual roles is more innovative and adaptive organizational culture.

**Keywords** Ambidextrous leadership · Knowledge sharing · Knowledge search · Strategic

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# 1 Introduction

Nowadays, technology-driven and fiercely competitive business environment have promoted innovation to an indispensable business strategy (Oluwafemi et al., 2020) which is a pivotal determinant of sustainable competitive improvement (Jia et al., 2022; Li et al., 2020; Mascareño et al., 2021). The implementation of innovation in the companies (Jia et al., 2022) ensures superior performance, fosters further growth, and secures the long-term survival of businesses (Anderson et al., 2014; Bagheri et al., 2019; Bodlaj et al., 2020; Lin et al., 2013; Mascareño et al., 2021; Oluwafemi et al., 2020; Zhou & Shalley, 2003). However, the intensification of dynamism, complexity, and ambiguity in the business environment poses challenges to make innovative decisions (Jia et al., 2022).

The previous research works indicate that companies can achieve a higher level of productivity and promote creativity and innovation by focusing on in-service industries (Haider et al., 2023; Rhee et al., 2017; Zhang et al., 2018). As a result, the role of human resources in organizations (Birkinsha et al., 2008; Ling and Nasuridin, 2010; Jian et al., 2012; Oluwafemi et al., 2020), including leadership as a critical factor in stimulating innovation (Anderson et al., 2014; Haider et al., 2023; Jyoti & Dev, 2015; Mascareño et al., 2021; Saeed et al., 2019a, 2019b; Shalley & Gilson, 2004; Tierney, 2008), and employees in discovering opportunities and creating innovative solutions beneficial for the organization in terms of finance and maintaining competitive advantage (Oluwafemi et al., 2020; Venkataraman et al., 2002) and its implementation (Hughes et al., 2018; West, 2002) is an essential issue among other strategies (Mascareño et al., 2021).

The leaders play a crucial role in allocating and controlling companies' resources in R&D (Research & Development) activities (Schaubroeck et al., 2017) that motivate the employees to adopt innovative behaviors and possibly foster creativity (Agarwal, 2014; Bos-Nehles & Veenendaal, 2019; Haider et al., 2023). Ambidextrous leadership implies that a qualified, innovative leader should cultivate both closed and open leadership styles and be able to flexibly switch between them (Jia et al., 2022; Oluwafemi et al., 2020). In today's competitive environment, this approach should facilitate the challenge of departing from conventional methods and strengthening work procedures through creative thinking and innovation for the employees (Duradoni & Di Fabio, 2019; Haider et al., 2023; Stoffers et al., 2019). It demonstrates two behaviors: One is open behaviors which encourage doing things differently, giving space for independent thinking and action, and supporting efforts to challenge fixed approaches. The second is closed behaviors which take corrective actions, setting specific guidelines, and monitoring goal achievement. These two guide and stimulate innovation along this path (Jia et al., 2022; Mascareño et al., 2021; Rosing et al., 2011).

Although previous studies have explored exploratory and exploitative innovative behaviours (Alghamdi, 2018; Oluwafemi et al., 2020; Smith & Tushman, 2005; Vaccaro et al., 2012) and investigated ambidextrous leadership and its impact on organizational innovation (Jia et al., 2022; Li et al., 2020; Zuraik et al., 2020), its effective mechanism has not been sufficiently explored (Alghamdi, 2018; Jia et al., 2022; Kassotaki, 2019; Li et al., 2020; Zacher & Rosing, 2015; Zacher & Wilden, 2014; Zacher et al., 2016). These studies often focus on a single leadership style that includes transformational leadership (Avolio Waldman & Einstein, 1988), servant leadership (Parris & Peachey, 2013) and ethical leadership (Sosik et al., 2014) or analyze differences between two leadership styles which are contrasting yet complementary (Jia et al., 2022; Rosing & Zacher, 2017; Zacher & Rosing, 2015), yielding heterogeneous results from positive to negative correlations (Bledow et al., 2011, Ryan & Tipu, 2013; Oluwafemi et al., 2020).

On the other hand, ambidextrous leaders require a culture of knowledge sharing (KSH) among their employees as it encourages individuals to enhance their knowledge, and improve their work performance at both the individual and organizational levels (Haider et al., 2023; Liu et al., 2020; Lopez-Fresno & Savolainen, 2019; Savolainen, 2019). Previous studies have also demonstrated that ambidextrous leaders can enhance knowledge search (KS) through various behaviors at different stages of the project (Ehls et al., 2020; Li et al., 2020; Lorinkova et al., 2013). Therefore, the importance of knowledge factors should be considered in future studies examining the relationship between ambidextrous leadership and innovation (Berraies & Zine El Abidine, 2019), as knowledge sharing and knowledge search are essential factors that may influence people's attitudes and ultimately their innovative work-behavior (Zhao et al., 2021). Quite often, employees need a high knowledge-sharing (KSH) attitude to be evidence for more innovative work-behaviour (IWB) (Akram et al., 2020; Haider et al., 2023; Javed et al., 2020; Stoffers et al., 2019).

The dynamics of switching between opening leadership behaviours (OLB) and closing leadership behaviours (CLB) depend on several features like changeability and flexibility (Zhang & Bartol, 2010), characteristics of leadership behaviour in response to unpredictable conditions (Yukl & Mahsud, 2010), changing positions and abilities, expectations, the nature of positions and employees' personalities (Jia et al., 2022; Li et al., 2020; Oluwafemi et al., 2020). High strategic flexibility differentiates the firm by making changes through mobilizing resources and capabilities and innovative activities which can promote transforming knowledge resources into innovation (Bamel & Bamel, 2018; Li et al., 2017). In this way, strategic flexibility offers excellent potential to improve the effects of knowledge searching on innovation (Li et al., 2017; Yuan et al., 2010).

Previous studies on ambidextrous leadership have primarily focused on its innovative outcomes (Alghamdi, 2018; Gebert et al., 2010; Hu et al., 2020; Ma et al., 2019; Zacher et al., 2016). However, little attention has been paid to the interaction between open and closed leader behaviors which are mainly based on self-report measures, and may be subject to biasness (Mascareño et al., 2021). Additionally, only one study has examined the role of ambidextrous leadership in the context of small and medium-sized enterprises (SMEs) (Oluwafemi et al., 2020), with most previous research focusing on large organizations (Bami-atzi et al., 2015; Chang & Hughes, 2012; Oluwafemi et al., 2020). Generally speaking, SMEs have limited human resources, financial resources, management expertise and they significantly differ from large firms (Oluwafemi et al., 2020).

The present study aims to achieve two main objectives: (1) investigation the impact of ambidextrous leadership with open and closed behaviors on employee innovation through the mediating role of knowledge sharing, and (2) examining the impact of ambidextrous leadership with open and closed behaviors on organizational innovation through the mediating role of knowledge search, focusing on small and medium-sized technology companies. Additionally, this research employs the social information processing theory (Salancik & Pfeffer, 1978) which posits that individuals regularly adjust their attitudes and actions based on cues such as the leader's conduct (Chen et al., 2013; Fernández-Pérez et al., 2013; Humayun and Gang, 2013; Hu et al., 2020; Salancik & Pfeffer, 1978).

With regard to the aforementioned objectives, the central research questions are: (1) Can ambidextrous leadership influence organizational innovation by enhancing employee innovation? (2) Can knowledge sharing (KSH) and knowledge search (KS) play a mediating role in the relationship between ambidextrous leadership and innovation? and (3) Can strategic flexibility act as a moderating factor in this relationship? The proposed study contributes to the ambidextrous leadership literature in three ways. Firstly, it provides an integrated understanding of employee and organizational innovation, elucidating the mediating role of knowledge

sharing and knowledge search (in the dimensions of exploration and exploitation) and clarifying the role of moderation by providing strategic flexibility within a researcher-made model. Secondly, it offers insights into the effects of ambidextrous leadership on employees and organizations for organizational leaders and managers. Lastly, it responds to the call for further research in this area (Haider et al., 2023; Jia et al., 2022). The subsequent sections will review the literature, research methodology, results, discussion, and conclusions.

## 2 Literature review

### 2.1 Social information processing theory

According to Social Information Processing theory, individuals create cognitions, attitudes, and behaviors at work, based on the processing of social cues (Hu et al., 2020; Liu et al., 2022; Salancik & Pfeffer, 1978; Wadei et al., 2021; Zheng et al., 2023). Social information processing theory asserts that “individuals, as adaptive organisms, adapt attitudes, behavior, and beliefs to their social context” are accounting for how leader activities correspond with follower reactions (Hu et al., 2020). According to social information processing theory (Salancik & Pfeffer, 1978), leaders’ characteristics influence their employees’ work behavior because employees actively use informational cues provided by their leaders to adapt their behavior to organizational norms and expectations (Bucher et al., 2022). Previous studies on social information processing theory have proven its implications for organizational leadership studies (Boekhorst, 2015; Ou et al., 2014; Peng et al., 2019; Yang et al., 2019). These studies emphasize on the importance of leaders in influencing employees’ opinions of the workplace (Boekhorst, 2015). According to some studies, leader ambidexterity provides compensatory means and conditions for followers to make inferences about workplace attitudes and behaviors (Gebert et al., 2010), which is especially valuable for those who lack adequate experience and knowledge about their roles and tasks. Using social information processing theory, we forecast how the two opposing leadership behaviors complement each other’s benefits in generating innovative results at both the employee and organizational levels (Salancik & Pfeffer, 1978).

Leaders play a critical role in molding views because they are a significant source of social information for their subordinates, and their actions can empower employees, affect their resources, and lead their performance (Zheng et al., 2023). Furthermore, we acknowledge that employees view their leaders’ behavior differently based on their personality traits (Bucher et al., 2022). The synergy between opening and closing leadership behaviors is beneficial according to social information processing theory because it determines how followers perceive the immediate work environment and, more specifically, how they interpret roles and capabilities inherent in the environment (Hu et al., 2020; Salancik & Pfeffer, 1978). The basic premise of this theory is that employees actively seek social cues to understand how to behave following company standards and expectations. The workplace, especially leaders, can provide informative cues to drive employee behavior (Frear et al., 2018). Furthermore, the satisfying followers are more concerned with their leaders’ interests and ideals, making them more likely to believe their leaders’ perspectives and intentions. It enables students to process and positively interpret social informational cues from leaders (Bucher et al., 2022). Thus, ethical leadership statements and behaviors provide a cue to members and show that members are safe, causing them to believe in themselves to undertake tasks and develop

unique outcomes (Wadei et al., 2021). Leaders explain organizational procedures and policies, displaying their behaviors, styles, and actions. These informational cues are frequently seen, evaluated, and used by employees or subordinates in the workplace to comprehend their leaders' behavioral expectations and requirements better. Employees can adjust their beliefs, attitudes, and behaviors accordingly (Yang et al., 2019).

According to SIP theory, social interaction between leaders and employees is a source of information used to define mental formation and behavioral reactions (Boekhorst, 2015). As a result, followers are encouraged to pursue exceptional work performance, including but not limited to completing more specified duties and achieving innovation. They also have more precise assessments of main hurdles and challenges. In this case, combination of the opening and closing leadership benefits both and improves employee's job performance synergistically. Similarly, according to social information processing theory, leaders' attitudes influence the follower's performance by transmitting role-relevant cues to followers (Hu et al., 2020).

Individuals may rely on multiple social cues, such as interpreting leaders' behavior, interacting with leaders, understanding the organizational environment, forming perceptions, and adjusting their behaviors due to the complexity of the organizational environment (Peng et al., 2019; Zheng et al., 2023). When confronted with various leadership characteristics, individuals process the information displayed by their leaders first. Then, indications from the workplace or surroundings may be used to interpret their leaders' behaviors, shape relevant views that modify their behaviors (Zheng et al., 2023). Finally, leaders frequently encourage follower learning by serving as role models. Overall, we propose a synergistic effect between closing and opening leadership on the outcomes of individual performance (Hu et al., 2020; Mom et al., 2009; Rosing et al., 2011; Zhang et al., 2015) based on social information processing theory (Salancik & Pfeffer, 1978).

## 2.2 Ambidextrous leadership

A set of two complementary leadership behaviors is called ambidextrous leadership. These behaviors may seem contradictory (Ahmad et al., 2022; Hou et al., 2022; Rosing et al., 2011; Zacher & Rosing, 2015) while each of them can provide an organizational context either for (1) promotion of exploration or (2) exploitation (Laser, 2022; Rosing et al., 2011). This new leadership style uses leadership as a combination of adaptive duality which are as follows: exploration versus exploitation, opening versus closing behaviors, alignment versus adaptability, radical versus incremental, flexibility versus efficiency. It combines the advantages of both the leadership styles (Akinici et al., 2022; Laser, 2022; Rosing et al., 2011). While both leadership styles are opposites, they can complement each other (Jia et al., 2022; Kung et al., 2020; Laser, 2022).

The previous studies show that opening and closing leadership have positive effect on team innovation. They can complement each other by enhancing different innovation processes so that team innovation performance is highest when both types of leadership are high (Deng et al., 2023; Rosing et al., 2011; Zacher & Rosing, 2015). In general, the management term 'ambidextrous leadership' refers to direct and frequent interactions between team leaders and team members (Rosing et al., 2011) and to perform (1) exploratory activities like experimentation, risk-taking, discovery and (2) exploitation like implementation, efficiency and execution is used in combination (Adler et al., 1999; Akinici et al., 2022; Alpkın & Gemici, 2016; Duc et al., 2020). Indeed, important employee and organizational outcomes such as creativity, innovation, and performance are linked to a balance between opening and closing

leadership behaviors that require leaders to apply them simultaneously to collect the experimentation and efficiency (Akıncı et al., 2022; Hou et al., 2022; Zacher & Wilden, 2014; Zacher & Rosing, 2015). However, leaders do not consistently achieve such a balance (Hou et al., 2022) that is necessary to strive to achieve this goal, ultimately organizational goals.

### 2.3 Opening leadership behaviors

Opening leadership behavior is a set of leaders' behaviors that includes the encouragement for doing things differently and experiment, giving room for independent thinking and acting, and supporting attempts to challenge existing approaches (Rosing et al., 2011, p. 967). It ensures superior variance in employee behaviors and leads to exploration (Alghamdi, 2018; Rosing et al., 2011; Zacher et al., 2016) which strengthens the exploration activities (Duc et al., 2020; Laser, 2022). Opening leadership increases followers' variation and includes leader behaviors to foster innovation and attempt to change existing approaches or create resources for independent thinking (Ahmad et al., 2022; Alghamdi, 2018). It allows alternative ways of doing things, encouraging critical thinking, motivating others to take risks, and supporting learning from mistakes (Deng et al., 2023; Rosing et al., 2011; Zacher & Rosing, 2015). By encouraging the team to do things differently, opening leadership behaviors are likely to equip them with more effective learning strategies, stimulate exploratory behaviors like critical thinking, experimentation, risk-taking (Deng et al., 2023; Duc et al., 2020; Zacher et al., 2016), and promote new ideas of innovations (Laser, 2022; Luu et al., 2019). Thus, they expand beyond the current knowledge search for new knowledge from customers, and improve the team's performance (Duc et al., 2020).

### 2.4 Closing leadership behaviors

Closing leadership behaviors encompass a set of leader behaviors aimed at reducing variation in team participant behaviors which includes corrective actions, setting specific instructions, and monitoring the achievement of the target (Duc et al., 2020; Rosing et al., 2011, p. 967). These behaviors reduce variance in employee behavior and facilitate the achievement of goals (Alghamdi, 2018; Deng et al., 2023; Laser, 2022; Zacher & Rosing, 2015; Zacher & Wilden, 2014; Zacher et al., 2016). Leaders through controlling goal progress, providing specific instructions, taking corrective actions, adhering to routines, or setting strict instructions (Ahmad et al., 2022; Alghamdi, 2018; Deng et al., 2023; Duc et al., 2020) may signal to team members to utilize their knowledge and current skills to focus on performing routine tasks without engaging in risky behaviors (Deng et al., 2023; Duc et al., 2020; Rosing et al., 2011; Zacher & Rosing, 2015). Leaders must flexibly switch between opening and closing leadership behaviors to assist their teams in meeting the needs of diverse innovation (Duc et al., 2020; Rosing et al., 2011). Therefore, in this article, the term "ambidextrous leadership" is used to generally refer to the promotion of exploration and exploitation by leaders such as board members, CEOs, vice presidents, senior managers, or critical managers within their area of responsibility to guide the behaviors.

### 2.5 Ambidextrous leadership and knowledge sharing

Ambidextrous leadership fosters innovation within a company (Haider et al., 2023; Kung et al., 2020). Opening leadership behaviors stimulate exploratory behaviors such as critical

thinking and promote new ideas and innovations that extend beyond current knowledge (Deng et al., 2023; Duc et al., 2020; Laser, 2022; Luu et al., 2019; Zacher et al., 2016). Conversely, the closing and exploitation behaviors of leaders by controlling goal progress and adhering to routines (Ahmad et al., 2022; Alghamdi, 2018; Deng et al., 2023; Duc et al., 2020) may signal team members to utilize their knowledge and current skills to focus on performing routine tasks without engaging in risky behaviors (Deng et al., 2023; Duc et al., 2020; Rosing et al., 2011; Zacher & Rosing, 2015). To succeed now and in the future, leaders must create organizations to be capable of engaging in both exploration and exploitation (Haider et al., 2023; Latham, 2014).

On the other hand, knowledge-sharing refers to the exchange of data, information, know-how, skills, feedback, and expertise among individuals to achieve their responsibilities and organizational objectives (Le & Lei, 2019; Lei et al., 2021; Myers & Cheung, 2008; Wang et al., 2016). The terms “exploration” and “exploitation” are frequently used by researchers. Exploration linked to irregular innovation and change involves to acquire new knowledge through research and development. On the other hand, exploitation pertains to incremental innovation and the utilization of current knowledge (Haider et al., 2023; Lee et al., 2020). Leadership significantly impacts employees’ willingness to share knowledge with transformational leaders who foster positive attitudes of the organizations and behaviors that promote knowledge-sharing (Lei et al., 2021; Manafi & Subramaniam, 2015). Effective leadership creates a positive environment conducive to knowledge-sharing, achieved through promoting employees’ intellectual capital, establishing clear vision and mission, and gaining trust and respect from followers (Choi et al., 2016; Masa’deh et al., 2016; Xiao et al., 2017). Additionally, adopting a transformational leadership style increases employees’ willingness significantly to share knowledge within the organization (Lei et al., 2020; Lei et al., 2021; Sheehan et al., 2020; Yin et al., 2019). Exploration which includes radical and incremental innovation can be performed simultaneously by ambidextrous leaders (Haider et al., 2023; Zhang et al., 2018). Therefore, this study proposes the following hypotheses:

**H1** Ambidextrous leadership has a positive relationship with knowledge-sharing.

## 2.6 Ambidextrous leadership and knowledge search

Current literature discusses extensively how managerial mindsets influence knowledge through leadership, fostering open innovation mindsets (Shi et al., 2023). Leaders manage and distribute an organization’s resources (Schaubroeck et al., 2017), significantly affecting its operations. Thus team leaders must expand their knowledge beyond their current understanding by seeking input from customers and enhancing team performance (Duc et al., 2020).

Having an open innovation mindset involves strategically starting and managing activities that include searching for knowledge (Shi et al., 2023). First-hand knowledge provides a unique advantage in competition (Duc et al., 2020). Leaders often encourage employees to take risks, experiment, and interact with the external environment while acquiring resources (Berraies and Abidine, 2019; Jia et al., 2022). They take the initiative in facing environmental risks and develop the organization’s capability to utilize explicit and tacit knowledge resources (Gebert et al., 2010; Jia et al., 2022). Leadership plays a crucial role in identifying potential sources of knowledge and determining knowledge acquisition strategies when firms develop their innovation strategies (Naqshbandi & Jasimuddin, 2018). Therefore, the literature on the micro-foundations of EKS recognizes leadership as a significant factor (Rangus &



Černe, 2019; Shi et al., 2023). Closing leader behaviors can establish explicit organizational norms and working models, promoting a collectivist culture that accelerates the integration of knowledge resources (Hu et al., 2020; Jia et al., 2022). Previous research indicates that organizational factors motivate EKS activities and senior management's attitude motivates the initiation of knowledge search activities (Bhatti et al., 2021; Shi et al., 2023).

Complementary leadership behaviors to balance knowledge search can effectively support the exploration and exploitation of knowledge. This approach promotes interaction as demonstrated by Alghamdi (2018), Zacher and Rosing (2015). An open innovative mindset helps companies to remain flexible and entrepreneurial, engaging in external knowledge search activities (Nestle et al., 2019; Shi et al., 2023). Ambidextrous leadership theory suggests that innovative team leaders should encourage both opening and closing leadership behaviors and switch between them as needed to facilitate knowledge search (Jia et al., 2022). The combination of opening and closing leadership behaviors aligns with ambidexterity, associated with increased innovation levels in team analysis (Duc et al., 2020; Zacher & Rosing, 2015). Ambidextrous leadership contributes to managing the competitive tensions between exploration and exploitation knowledge search, leveraging the strengths of both types of search while minimizing their weaknesses. It helps to prevent the organizations from falling into "success traps" or "failure traps" and ultimately increases the efficiency of knowledge transfer within the organization (Jia et al., 2022). Therefore, this study assumes the following hypotheses:

**H2** Ambidextrous leadership has a positive relationship with knowledge search.

**H2a** Opening leadership behaviors have a positive relationship with exploration knowledge search.

**H2b** Closing leadership behaviors have a positive relationship with exploitation knowledge search.

## 2.7 Knowledge-sharing and employee innovation

For enterprises to remain competitive, knowledge emerges as a crucial resource. Continuous knowledge sharing and communication within the organization are necessary to foster innovative thinking and behavior (Jing et al., 2022). Explicit knowledge refers to information that is documented and readily shared through documents. Conversely, tacit knowledge is personal and context-specific, often derived from practical experience and reflections. Many argue that both forms of knowledge yield numerous positive outcomes for individuals and organizations (Ononye, 2022).

Individuals and groups can contribute their knowledge to the organization, aiding in the development of new products, services, and processes (Yuan & Ma, 2022; Zeffane et al., 2011). Knowledge sharing exchanges the implicit and explicit knowledge among employees through interactions (Ononye, 2022). It is crucial for enhancing innovation within enterprises by unlocking the potential of diverse cognitive resources (Jing et al., 2022). Knowledge sharing serves as a valuable tool that promotes innovative behavior, stimulates critical thinking, and supports the translation of ideas into innovative actions (Wang & Noe, 2010; Yuan & Ma, 2022). Sharing knowledge within and outside a company helps to overcome the pitfalls of hoarding knowledge. This approach fosters innovation and enhances a company's adaptability to new situations. Studies by Jing et al. (2022) and Castenda and Cuellar (2020) support the notion that innovation is unlikely without knowledge sharing. Jing et al. (2022) show that



knowledge sharing significantly influences employees' ability to innovate. Thus, the authors propose the following hypothesis:

**H3** Knowledge-sharing has a positive relationship with employee innovation.

## **2.8 Knowledge search and organizational innovation**

From a knowledge-based perspective, knowledge plays a vital role in enhancing enterprise capabilities and facilitating the development of products and services (Zhang et al., 2022). Recent academic research on knowledge search has been studied extensively (Duan et al., 2023; Shi et al., 2019; Wang et al., 2020; Jia et al., 2022; Wang et al., 2021; Ricci et al., 2021; Torres de Oliveira et al., 2022). According to Ndofor and Levitas (2004), knowledge lies at the core of an organization's responsiveness to environmental changes (Zhang et al., 2022). Search width (explorative search) and search depth (exploitative search) are two frequently advocated methodologies for knowledge search (Caner & Tyler, 2014; Eriksson et al., 2016; Katila & Ahuja, 2002). Within the constraints of limited resources, this study contends that inevitable tensions and contradictions exist between exploitative and explorative searches (Jia et al., 2022). Knowledge search is a problem-solving activity within organizations that involves generating and reorganizing technical concepts (Katila & Ahuja, 2002; Nelson & Winter, 1982; Zhang et al., 2022). According to the ambidextrous hypothesis, exploitation and exploratory searches are both independent and synergistic (He & Wong, 2004; Jia et al., 2022). Exploration is defined as "variation, risk-taking, and experimentation," whereas exploitation is demarcated as "a directed search emphasizing limiting variety and closely building on the existing knowledge base" (Eriksson et al., 2016). Thus, exploitation entails refinement, alignment, control, efficiency, and a focus on the short term (Gibson & Birkinshaw, 2004; March, 1991). According to Miller et al. (2006), exploitation produces rapid conformity to codified beliefs and practices, whereas explorations, a slower learning process, is required to scope nonconforming beliefs and persist practices (Eriksson et al., 2016). Similarly, exploration of knowledge searching seeks new possibilities, leading to the comprehensive creation of new market and knowledge of technology required for organizations to innovate. These new types of knowledge enable organizations to better understand the de facto state of business and make accurate decisions on innovation (Jia et al., 2022).

Exploitation knowledge search focuses on knowledge within an organization's existing domains (Shenkar & Li, 1999), which can deepen understanding of knowledge in a specific field and motivate organizations to search for new knowledge irrelevant to an organization's existing knowledge base (Ehls et al., 2020; Jia et al., 2022), further assimilating and using this novel knowledge (Cohen & Levinthal, 1990; Jia et al., 2022). Consequently, enterprises must allocate attention resources properly and strike an appropriate balance between the two (Duan et al., 2023). Searching for knowledge outside the organization can enhance the speed of product development, product quality, and the likelihood of achieving more significant innovation (Chai, 2017; Eggers et al., 2012; Zhang et al., 2022). The chosen search approach sets the tone for information exchange and consequently, establishes typical routines and knowledge that foster innovative behavior (Eriksson et al., 2016). Therefore, this study assumes:

**H4** Knowledge search has a positive relationship with organizational innovation

## 2.9 Employee innovation and organizational innovation

In the context of the third industrial revolution and the globalized digital economy, organizations are becoming knowledge-based and their survival and eventual success rely heavily on exploration, creativity, and innovation (Alawamleh et al., 2023). Alawamleh et al., 2023; Baregheh et al., 2009) define innovation as an organizational renewal process to adapt external concerns or change an environment to obtain a competitive advantage. There are numerous definitions of innovation. Firstly, many researchers have argued that creativity entails innovation. For example, Rogers (1995) defines innovation as creating a new thing, activity, or concept based on evaluating an individual or another adoption unit (Alameri et al., 2019).

From an economic standpoint, Schumpeter and Nichol (1934) describe innovation as essential to economic change and progress, emphasizing its macroeconomic importance for national economies. More socially-focused perspectives see it as a supportive approach that helps organizations to be better by delivering long-lasting and reusable goods and services to address social and environmental challenges (Alawamleh et al., 2023; Bocken & Geradts, 2020). Regardless of where one falls on this spectrum, creativity is a necessary component of innovation, whether it involves developing new or better products and services. However, the practical application of creative innovation depends on market viability, as well as on the support of organizational human and operational resources, as well as financial capital (Ahlin et al., 2014; Alawamleh et al., 2023). Additionally, Rogers (1995) proposed the idea of innovation diffusion which focuses on how innovations spread among the individuals that make up a social system over time through various channels (Alameri et al., 2019).

The period of idea generation is calculated when employees' innovative behavior most frequently aligns with creative efforts (Bäckström & Bengtsson, 2019). Employees develop typically and promote organizational innovations, encouraged and supported by successful leadership (Ashfaq et al., 2021; Castro & Guimaraes, 2020; Gui et al., 2021; Lopes Henriques et al., 2019). Previous researches carried out by Selvaraj and Joseph (2020) and Rasheed et al. (2017) find positive relationships between employee voice and employee innovation (Ashiru et al., 2022).

Furthermore, the effects of human resource policies on firm innovation suggest that firms' implementing policies to stimulate job autonomy and performance-based pay are more likely to innovate. Krammer (2022) examines training and development as mechanisms that enhance skills and build new resources and capabilities, enabling employees to create and innovate (Ubeda-Garcia et al., 2014). Autonomy is a related key contributing factor to maximizing employee satisfaction which is correlated positively with innovative behavior (Alawamleh et al., 2023; Lee et al., 2021; Ohly et al., 2006). Employee voice and employee innovation have been favorably linked in previous studies by Selvaraj and Joseph (2020), Rasheed et al. (2017) and Ashiru et al. (2022). Training and development are mechanisms that enhance skills and build new resources and capabilities, enabling employees to create and innovate (Ubeda-Garcia et al., 2014). Employee autonomy at work results from psychological empowerment. Employees feel that they have contributed and invested to the success of a organization when they accept activities and make judgments about them which promotes innovation (Alawamleh et al., 2023; Deci & Ryan, 2008; Singh & Sarkar, 2012). Consequently, this study assumes:

**H5** Employee innovation has a positive relationship with organizational innovation.

### 2.9.1 The mediating role of knowledge-sharing

Knowledge management is the collection of skills that an organization can use to produce, distribute, and apply knowledge resources to gain value and competitive advantage (Lee et al., 2016; Lei et al., 2021; Sun et al., 2020). The performance of knowledge-sharing (KS) activities within an organization determines largely the success of knowledge management projects (Le & Lei, 2019). Knowledge-sharing (KS) corresponds to the elements of knowledge that helps others or exchanges the knowledge (Yu et al., 2013). According to Bartol and Srivastava (2002), four main factors encourage people to share their knowledge within a company: (1) committing information to hierarchical databases; (2) sharing informal organizational information among team members; (3) information exchange in casual collaborations between individuals; and (4) information exchange within networks of training which are intentional discussions between representatives and a subject. Due to the significant impacts of KS on key organizational outcomes like firm performance, organizational productivity, absorptive and innovation capacity, and sustainable competitive advantage, current literature focuses on these distinctions (Lei et al., 2019; Lei et al., 2021; Shao et al., 2015; Wang et al., 2016). Manafi and Subramaniam (2015), Masa'deh et al. (2016), Choi et al. (2016) and Xiao et al. (2017) all agree with the fact that leaders might provide an environment where employees can develop their knowledge and abilities while also being encouraged to share their knowledge and experience with other employees. Under strong leadership, workers are more likely to be open about their unique knowledge and skills because they are motivated to work together towards a common objective and think their boss and coworkers are trustworthy (Lei et al., 2019). In other words, sharing knowledge enables coworkers to learn practical information, and discussions encourage finding out creative problem-solving and creativity in the workplace (Gerlach et al., 2020). As a result, Hypothesis 6 is built as follows:

**H6** Knowledge-sharing mediates the relationship between ambidextrous leadership and employee innovation.

### 2.9.2 The mediating role of knowledge search

Knowledge is the foundation of an organization's response to environmental changes and is a crucial resource for enhancing organizational competence and the development of new products and services (knowledge-based view; Zhang et al., 2022). According to Katila and Ahuja (2002) and Nelson and Winter (1982), knowledge searching is an organizational problem-solving activity that entails producing and organizing technical ideas. It can be said that ambidextrous leadership affects organizational innovation by combining opening and closing leadership behaviors after moving into the scope of knowledge search and after moving into the path of the depth of knowledge search after exploratory knowledge search. More specifically, opening leaders frequently inspire their staff to look for opportunities in the continuously evolving creative environment and create an environment that encourages inquiry and searching knowledge (Oluwafemi et al., 2020). When compared to expertise found within an organization, seeking knowledge outside of it can speed up product development, increase product quality, and even open the door to more incredible innovation (Zhang et al., 2022). Contrarily, closing leaders tend to encourage employees to complete tasks conventionally and efficiently, obstructing their pursuit of opportunities outside their areas of expertise (Zacher and Wilden, 2014) and causing them to concentrate on prior knowledge (Alghamdi, 2018). Nevertheless, demonstrating both opening and closing behavior is not a

guarantee of success. Integrating new knowledge into an organization is crucial to its operation (Zhang et al., 2022). It helps to eliminate the failure of consequences of knowledge search, acquire unique and valuable knowledge pieces, prevent competency traps, avoid core rigidity, and support organizational innovation (Ehls et al., 2020).

Ambidextrous leadership is the ability of a leader to flip between those two behaviors with ease to fulfill the needs of new jobs. Through integration of thinking, ambidextrous leaders may establish appropriate innovative goals for organizations (Rosing et al., 2011; Zacher & Rosing, 2015). For example, they can use different behaviors to encourage employees to carry out knowledge search activities at different stages of a project (Berraies & Abidine, 2019; Li et al., 2020) and to encourage organizations to take risks, make attempts, and proactively explore new knowledge (Ehls et al., 2020; Jia et al., 2022) which would ultimately provide knowledge resources for the accomplishment of innovative tasks (Jia et al., 2022; Wang et al., 2020). As a result, the following hypothesis is put forth:

**H7** Knowledge search has a mediating role in the relationship between ambidextrous leadership and organizational innovation.

### 2.9.3 The moderating role of strategic flexibility

The strategic flexibility is an inherent flexibility in a firm's resources that enables the organizations to make the necessary internal changes in response to new external events (Brozovic, 2018; Dai et al., 2018; Herhausen et al., 2021; Jia et al., 2022; Kafetzopoulos et al., 2022). To make their organizations flexible to unpredictable circumstances, leaders must be able to adopt change-oriented strategies, inspire people to achieve goals, and seek new opportunities (Jansen et al., 2009; Kafetzopoulos et al., 2022). From a knowledge-based perspective, strategic flexibility emphasizes the importance of timely responses to changes in the external dynamic environment for enterprises. However, it also maintains that such timely responses result from organizational flexibility within its walls and the ability to use those resources (Brozovic, 2018; Jia et al., 2022; Nadkarni & Narayanan, 2007). Strategic flexibility promotes the achievement of competitive advantage, mainly when firms operate in a dynamic environment (Zahra et al., 2008), and it is regarded as the organization's key factor in achieving excellence in the twenty-first century (Kafetzopoulos et al., 2022). This is because the business environment is uncertain due to rapidly changing technological innovation and globalization. Thus strategic flexibility is crucial to the firm's effectiveness and performance (Wadstrom, 2019; Xiu et al., 2017; Kafetzopoulos et al., 2022).

Leaders are essential to achieving higher levels of strategic flexibility in their organizations because they can better understand how strategic options fit the business environment, gather and interpret information, make strategic decisions, and express upper-echelon concepts. Instead, strategic flexibility may increase the value of resources for innovation (Jia et al., 2022) since it can help organization's structure and coordinate different resources and functional units (Zander & Kogut, 1995). In order to overcome organizational inactivity, allocate the necessary resources, and promote creativity and innovation attributes in organizations as they aid in searching for new business opportunities, strategic flexibility should be applied holistically (Kafetzopoulos et al., 2022; Zhou & Wu, 2010). A robust knowledge search would lead to more incredible organizational innovation performance when strategic flexibility is high (Ehls et al., 2020; Flor et al., 2018; Sanchez, 1995). By emphasizing the flexible use of resources for new courses of action, strategic flexibility can create a suitable environment where organizations can better absorb and use new knowledge and information from internal

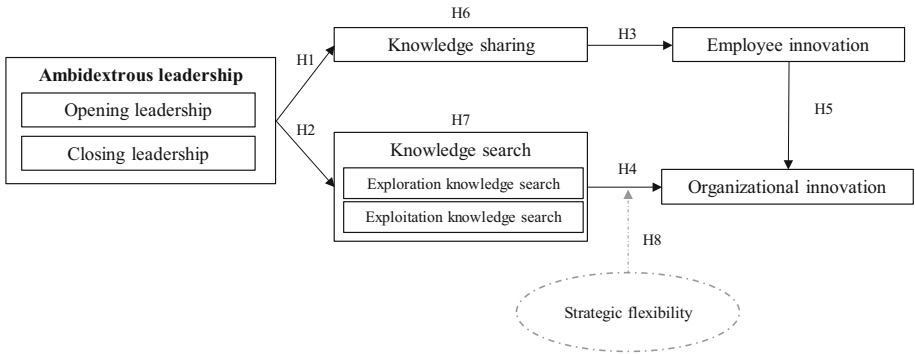


Fig. 1 Conceptual research model

and external environments (Bamel & Bamel, 2018). It can strengthen the organizational absorptive capability of exploitation of innovation (Jia et al., 2022; Matthysens et al., 2005; Zhou & Wu, 2010). Therefore, the following hypothesis is proposed:

**H8** Strategic flexibility has a moderating role in the relationship between Knowledge search and organizational innovation.

The concept of the proposed study is sketched in Fig. 1.

### 3 Research methodology

This research has a descriptive purpose, utilizing a positivist research philosophy, applied research perspective, deductive approach, and survey strategy (Table 1). The current study employs quantitative data gathering to correlate constructs and reveal correlations between study variables (Delice, 2010). A population sample represents the features of the population. Collecting data from the complete population is impossible due to time and resource restrictions. Therefore, a primary random sampling method is utilized to collect and analyze the data (Gupta & Shabbir, 2008). The population comprises of C-level managers of small and medium-sized technology-based businesses. As a result, primary random sampling is used as a sampling approach. After removing incomplete responses, the sample size

Table 1 Research design

Items	Method
Philosophy	Positivism
Approach	Deductive
Purpose	Descriptive
Strategy	Survey
Choice	Mono-method
Time horizon	Cross sectional
Techniques and procedures	Data collection and data analysis
Software	SmartPLS

is determined using the Cochran (1963) formula, and 384 valid surveys are utilized to test the hypotheses. The sample and respondents in this study are executives who works for these organizations as board members, CEOs, vice presidents, senior managers, or managers with critical responsibilities. Two months of data collection are completed between July 2023 and June 2023.

The study is cross-sectional because the data are gathered at a single point in time (Olsen & St. George, 2004). Established measures from previous literature are adopted in this study. Each question is evaluated using a five-point Likert scale: 1 for Strongly Disagree, 2 for Disagree, 3 for Neutral, 4 for Agree, and 5 for Strongly Agree. This instrument is ideal for data collection since it allows for the rapid and simple collection of quantitative data (Haider et al., 2023). Cronbach's (1951) alpha is used to assess the reliability of the latent variables. The Cronbach's alpha cutoff value is more than 0.70 for all structures, and 0.7 has been recommended (Henseler et al., 2009; Taber, 2018). Cronbach's alpha results are shown in Table 2. A fourteen-item scale developed by Zacher and Rosing (2015) and adapted from articles by Haider et al. (2023) and Jia et al. (2022) is used to examine ambidextrous leadership, with an alpha reliability of 0.791. Haider et al. (2023) use a five-item scale with an alpha reliability of 0.892 to assess knowledge-sharing as the mediator variable. Jia et al.'s (2022) ten-item scale with an alpha reliability of 0.841 is used to assess knowledge search as the mediator variable. Jia et al.'s (2022) five-item scale with an alpha reliability of 0.878 is used to assess the dependent variable organizational innovation, and Haider et al.'s (2023) five-item scale with an alpha reliability of 0.902 is used to assess the dependent variable employee innovation. In order to measure discriminant validity, the structural equation model (SEM) is examined, which include predictive relevance ( $Q^2$ ), variance ( $R^2$ ), and effect size ( $f^2$ ). Convergent validity, factor loading, and discriminant validity are also tested using the hetero-trait-mono-trait (HTMT) ratio in the multivariate fact-based tests (Sarstedt et al., 2019). IBM SPSS Version 21 and Smart PLS SEM Version 3.2.8 are utilized in the study (Henseler et al., 2015). The measurement of first phase of the model is examined to verify the questionnaire and identify the components that should quantify and ensure the instrument's dependability. The bootstrapping approach is used to test the significance level for loading, path coefficients, and weights on 387 individuals (Hair et al., 2016). This approach includes Cronbach's alpha assessment, Dillon–Goldstein's Rho-A, factor loading measures, average variance extracted (AVE), and composite reliability (CR). Figure 2 shows how the questionnaire is used to collect data. The following are the seven major phases of the proposed technique: Following a study of the literature, the following steps are taken: (2) goal setting; (3) research design; (4) data collection; (5) data analysis; (6) results and discussion; and (7) conclusion, limitations, and future research ideas.

The data analysis utilizes inferential statistics, structural equation modeling, and model-appropriate methodologies. At first, the fitting of the model is evaluated, and then the hypotheses are tested using Smart PLS software. The software has some trivial limitations but possesses sufficient analysis power (Harandi & Mirzaeian Khamseh, 2023). PLS-SEM (Partial least squares structural equation modeling) is widely used to estimate the relationships between latent variables and path models. One of the main objectives of PLS-SEM analysis is to determine the essential factors that contribute to the success and competitive advantage of critical target constructs (Sarstedt et al., 2021).

For instance, leadership behavior is one of the crucial areas that researchers focus on the examining of PLS-SEM models. Additionally, PLS-SEM is recognized as a sophisticated analytical method because it can simultaneously model mediation and moderation (Alzghoul et al., 2024). To validate, solve, and analyze the suggested problem, several techniques like simulation-based optimization, fuzzy uncertainty, and the hybrid multi-objective

**Table 2** Measurement of the model

Construct's		Factor loading	$\alpha$	Rho-A	CR	AVE
Employee innovation	EI1	0.890	0.878	0.909	0.911	0.677
	EI2	0.896				
	EI3	0.875				
	EI4	0.620				
	EI5	0.799				
Knowledge sharing	KS1	0.746	0.892	0.901	0.921	0.700
	KS2	0.818				
	KS3	0.839				
	KS4	0.897				
	KS5	0.876				
Moderating effect 1	Knowledge search_ * Strategic flexibility_	1.069	1.000	1.000	1.000	1.000
Organizational innovation_	OI1	0.842	0.902	0.905	0.928	0.720
	OI2	0.875				
	OI3	0.875				
	OI4	0.870				
	OI5	0.776				
Ambidextrous leadership	Opening leadership	0.956	0.791	0.894	0.726	0.590
	Closing leadership	0.516				
Strategic flexibility	SF1	0.644	0.889	0.906	0.920	0.700
	SF2	0.798				
	SF3	0.893				
	SF4	0.918				
	SF5	0.900				
Knowledge search	Exploitation knowledge search	0.919	0.841	0.851	0.926	0.863
	Exploration knowledge search	0.938				

optimization algorithm—MOSA-MOIWOA are used to address the complexity of optimization problems which are insufficient. Numbers are employed to quantify this uncertainty since the computational results demonstrate that decentralized planning and control are necessary when risk variables or risk-taking behavior continue to rise (Goli et al., 2023; Tirkolae et al., 2023).

Out of 384 participants in the survey, 85 (22.1%) are women, and the rest (77.9%) are men. Of these, 18 people, equal to 4.7%, are over 60 years old; 25 people, equal to 6.5%, are between 21 and 30 years old; 36 people, equal to 9.4%, are between 31 and 40 years old; 149 people, equal to 38.8%, are between 41 and 50 years old; and 156 people, equal to 40.6%, are between 51 and 60 years old. Regarding education, 1.6% have a diploma, 12.8% have a bachelor's degree, 41.4% have a master's degree, and 44.3% have a PhD degree and



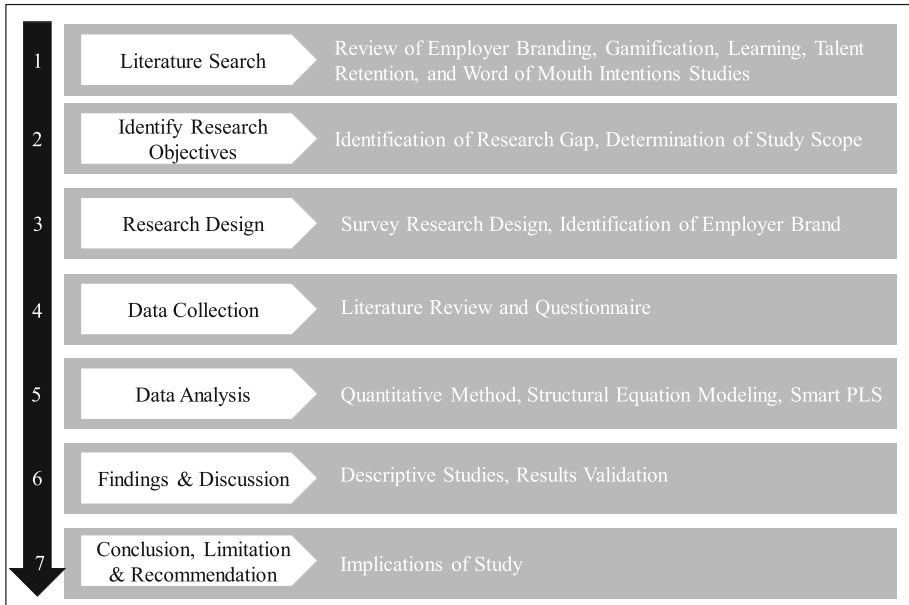


Fig. 2 Research process

above. Regarding the organizational posts, 6% are executive vice presidents, 14.1% are board members, 32.8% are managers and consultants, 34.6% are CEOs, and 12.5% hold other posts.

Regarding job experience, 16.1% have less than eight years of experience, 38.8% have nine to sixteen years of experience, 34.1% have seventeen to twenty-four years of experience, and 10.9% have twenty-four or more years of experience. All items utilized in the surveys are drawn directly from pre-existing data sources. Before the large-scale investigation, pilot research is undertaken to ensure the instrument's validity.

## 4 Results and discussion

The validity of explicit indicator hypotheses can be examined by assessing their factor loadings where a loading of greater than 0.50 on two or more components is significant (Hair et al., 2014). Therefore, the findings of the variables serve as legitimate measures of their constructs which is depicted in Fig. 3. Convergent validity of a variable is acknowledged when the average variance extracted (AVE) is less than 0.5 and the composite reliability (CR) is more than 0.6, as proposed by Fornell and Larcker (1981). Figure 3 illustrates the convergent validity measurement model (Fig. 4). Additionally, the HTMT approach suggested by Henseler et al. (2015) is employed. The HTMT approach is used to assess the distinctiveness of various constructs in two ways. Firstly, the HTMT threshold value is determined where a result greater than the threshold indicates a lack of discriminant validity. The exact HTMT cutoff value is debatable when the correlation is close to one. Some researchers provide a threshold value of 0.85 (Voorhees et al., 2016), while others advocate a value of 0.90 (Ab Hamid et al., 2017). Secondly, discriminant validity is assessed by evaluating the confidence

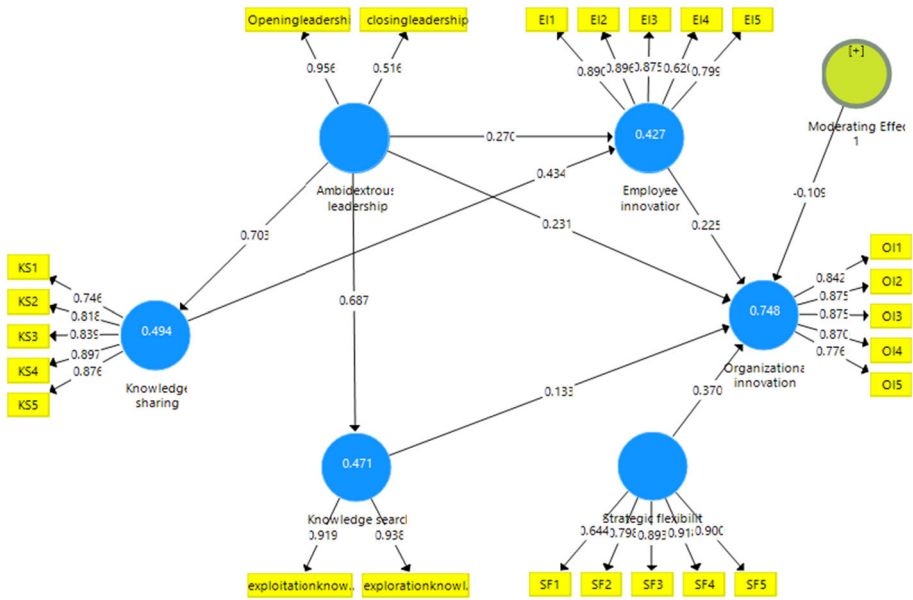


Fig. 3 Structural equations model

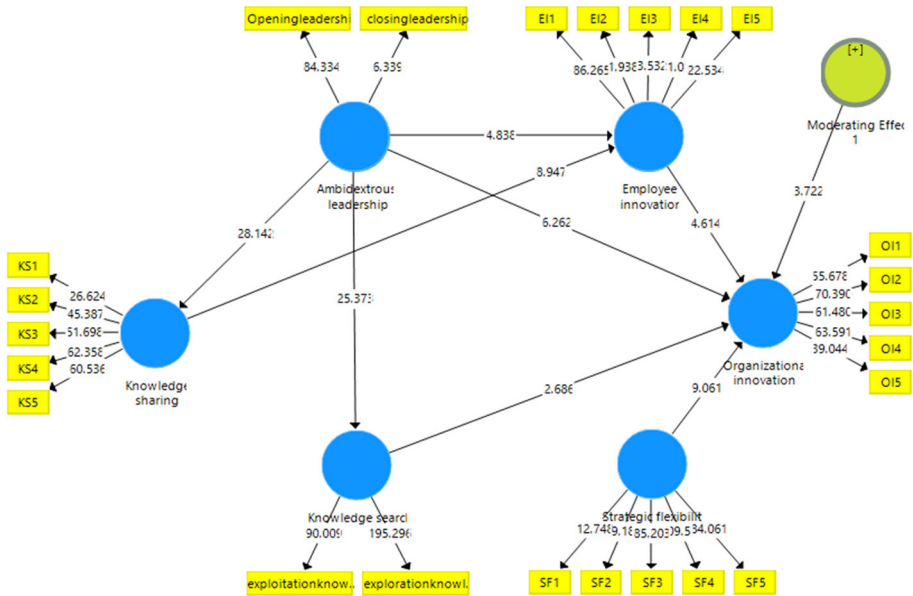


Fig. 4 PLS-Path analysis of (n = 5000 bootstrapped samples)

intervals of the HTMT values which are less than 1. If a variable is removed from the interval range, it indicates empirical evidence for the distinctiveness of variables.

According to Table 3, the HTMT values for constructs are all less than 0.85 which indicate that discriminant validity has been established in this investigation. Following the completion of the measurement model, the structural equation model (SEM) is calculated.

The direct and indirect impacts of the SEM are examined using four specific criteria. Firstly, the variance values explained by all variables are determined by evaluating the  $R^2$  level for endogenous latent constructs (Hair et al., 2016). According to Cohen (1988),  $R^2$  values of 0.13, 0.26, and 0.09 represent moderate, high, and low values, respectively. However, the direct effect of the proposed model for endogenous variables reveals that employee innovation has an  $R^2$  value of 0.427. It is found that having leaders who are ambidextrous and promote information sharing can lead to a significant increase of 42.7% in employee innovation. Additionally, the  $R^2$  for knowledge search is 0.471, indicating that ambidextrous leadership can anticipate 47.1% of the change in knowledge search. Moreover, knowledge sharing has an  $R^2$  of 0.49 which suggests that ambidextrous leadership can anticipate a shift in knowledge sharing of 49.4%. Furthermore, organizational innovation's  $R^2$  is 0.748 which shows that knowledge search and ambidextrous leadership can predict 74.8% of changes in organizational innovation.

The coefficient of determination for all endogenous variables demonstrates the quality of the structural model based on the findings of Table 4, which shows the model's vital prediction accuracy.

The model's predictive relevance ( $Q^2$ ) is assessed using a cross-validation redundancy approach (Hair et al., 2016). As shown in Table 4 (Employee innovation  $Q^2$ : 0.272, Knowledge search  $Q^2$ : 0.401, Knowledge sharing  $Q^2$ : 0.339, and Organizational innovation  $Q^2$ : 0.517), the predictive relevance of the model is good. The results demonstrate that ambidextrous leadership has a direct, significant, and advantageous impact on knowledge sharing ( $\beta = 0.7, p = 0.000$ ); ambidextrous leadership to knowledge search ( $\beta = 0.68, p = 0.000$ ); knowledge sharing to employee innovation ( $\beta = 0.43, p = 0.000$ ); knowledge search to organizational innovation ( $\beta = 0.13, p = 0.007$ ); and employee innovation to organizational innovation ( $\beta = 0.22, p = 0.000$ ). The above outcomes support the hypotheses H1, H2, H3, H4 and H5. Additionally, according to Hair et al. (2016), the effect size ( $f^2$ ) measures the impact of an independent variable on the dependent variable to estimate the magnitude of an exogenous effect on an endogenous variable (Urbach & Ahlemann, 2010). The effects with an estimated size estimate between 0.02, 0.15 and 0.35 are classified as medium, small and large, respectively (Asad et al., 2024; Hair et al., 2021; Sarstedt et al., 2022). All relationships have small to large effect sizes. Table 5 indicates a negative relationship between the moderating effect of strategic flexibility between knowledge search and organizational innovation ( $\beta = -0.10, p < 0.000$ ). Therefore, the results show that the hypothesis H8 is not supported. Finally, the hypotheses of the model propose and validates that knowledge-sharing mediates the relationship between ambidextrous leadership and employee innovation, and knowledge search mediates the relationship between ambidextrous leadership and organizational innovation.

The findings have demonstrated that hypotheses H6 and H7 are acceptable. Additionally, the direct effects of opening leadership behaviors on knowledge exploration ( $\beta = 0.680, p = 0.000$ ) and closing leadership behaviors on knowledge exploitation ( $\beta = 0.530, p = 0.000$ ) are both substantial and beneficial. The findings indicate that hypotheses H2.a and H2.b are validated.

After fitting the measurement and structural components of the model, the overall fitting is evaluated using the goodness-of-fit (GOF) criterion. The criteria for classifying the strength of the relationship between variables are characterized as weak, medium, and vital for the

**Table 3** Discriminant validity: hetero-trait–mono-trait ratio (HTMT)

	Ambidextrous leadership	Employee innovation	Knowledge search	Knowledge sharing	Moderating Effect I	Organizational innovation	Strategic flexibility
Ambidextrous leadership	0.768						
Employee innovation	0.575	0.823					
Knowledge search	0.687	0.644	0.929				
Knowledge sharing	0.703	0.624	0.702	0.837			
Moderating Effect I	-0.269	-0.190	-0.375	-0.203	1.000		
Organizational innovation	0.746	0.675	0.748	0.716	-0.323	0.848	
Strategic flexibility	0.709	0.565	0.723	0.751	-0.139	0.774	0.837

**Table 4** Coefficient of determination in the PLS method

Constructs	R Square	R Square adjusted	Q <sup>2</sup>
Employee innovation	0.427	0.424	0.272
Knowledge search	0.471	0.470	0.401
Knowledge sharing	0.494	0.493	0.339
Organizational innovation	0.748	0.744	0.517

**Table 5** Results of the structural equations model

	Hypothesis	$\beta$	t-values	p-values	
	Direct effect				
H1	Ambidextrous leadership-knowledge-sharing	0.70	28.14	0.000	
H2	Ambidextrous leadership- knowledge-search	0.68	25.37	0.000	
H3	Knowledge-sharing- employee innovation	0.43	8.94	0.000	
H4	Knowledge search-organizational innovation	0.13	2.68	0.007	
H5	Employee innovation-organizational innovation	0.22	4.61	0.000	
	Mediating effect		Sobel test	p-values	
H6	ambidextrous leadership-Knowledge-sharing-employee innovation		6.97	0.000	
H7	ambidextrous leadership-Knowledge search organizational innovation		7.22	0.000	
	Moderating effect		$\beta$	t-values	p-values
H8	Knowledge search-Strategic flexibility-organizational innovation		- 0.10	3.72	0.000
	Direct effect		$\beta$	t-values	p-values
H2. a	Opening leadership behaviours-exploration knowledge search		0.68	27.18	0.000
H2. b	Closing leadership behaviours-exploitation knowledge search		0.53	23.65	0.000

values 0.01, 0.25 and 0.36 respectively. The calculation of this criterion is based on the following equation.

$$GOF = \sqrt{\text{Communalities} \times \overline{R^2}} \quad (1)$$

As shown in Table 6, communalities denote the average coefficient of determination for

**Table 6** The number of communalities and  $R^2$ 

Latent variable	Communality	$R^2$
Ambidextrous leadership	0.024	–
Employee innovation	0.520	0.427
Knowledge search	0.488	0.471
Knowledge sharing	0.546	0.494
Moderating Effect 1	1.000	–
Organizational innovation	0.571	0.748
Strategic flexibility	0.555	–

**Table 7** The overall fitness of the model

GOF	$\overline{R^2}$	$\overline{\text{Communality}}$
52.0	0.53	<b>0.52</b>

the endogenous variables, and  $(\overline{R^2})$  represents the average communal values of the research variables.

The overall fitness of the firm is derived by the GOF value of 0.52 which is displayed in Table 7.

This study follows two objectives based on the social information processing theory: (1) To examine the effects of ambidextrous leadership with open and closed behaviors on employee innovation through the mediating role of knowledge sharing, and (2) To examine the effects of ambidextrous leadership with open and closed behaviors on organizational innovation through the mediating role of knowledge search.

Additionally, this study investigates the technology-based businesses in Iran for the following reasons: 1. Technology enterprises need to scale quickly and pivot even more quickly in a sector where innovation is both an opportunity and a danger. The technology sector is one of our global economy's most active and important segments. Nevertheless, not all boats are inevitably lifted when the tides are rising (Bain & company, 2023). 2. In today's corporate world, technology is the road from desire to impact (McKinsey & Company, 2022). Industrial disruption is accelerated by technology which serves as a differentiator (McKinsey & Company, 2020). Additionally, this research has made significant advancements to better understand the use of ambidextrous leadership and the impact of employee innovation on organizational innovation with the mediating role of knowledge sharing and knowledge search. Eight main hypotheses and two supporting hypotheses are put forth in this study. Since the relationships between the variables in the first five hypotheses are more significant than the absolute value of 1.96, and it is possible to measure the correctness of the first five hypotheses with 95% confidence level. Hypothesis testing supports our first hypothesis that ambidextrous leadership positively correlates with knowledge sharing. This part of our findings is consistent with Haider et al., (2023). Because knowledge is an integral part of expanding awareness throughout the organization, and its distribution, sharing and management can support leadership as a supporting tool so that the company or organization achieves its goals (Haider et al., 2023; Lei et al., 2020).

In this study, the second hypothesis is also confirmed. This finding, consistent with the findings of Jia et al.'s (2022) study, shows that ambidextrous leadership positively correlates with knowledge seeking. Two further secondary findings from this study are verified. The findings indicate that opening leadership significantly and favorably affects knowledge exploration, while closing leadership favorably affects knowledge search. Therefore, H2a and H2b are validated. According to the third hypothesis of this research, knowledge sharing has a positive relationship with employee innovation, which is also confirmed and is consistent with the results of Haider et al. (2023). As stated by social information processing theory, leaders are a significant source of social information for their subordinates and, as facilitators by sharing knowledge that encourages innovative behavior, play a critical role in molding views (Yuan & Ma, 2022; Zheng et al., 2023). Also, based on the fourth hypothesis of this research, knowledge search has a positive relationship with organizational innovation, and the findings of this hypothesis support the hypothesis test results of Jia et al. (2022). According to social information processing theory, leader behavior affects followers' performance by transmitting cues (Hu et al., 2020) such as knowledge search that determines how followers perceive the work environment.

According to the H5 of this research, employee innovation has a positive relationship with organizational innovation. Our findings confirm the results of Bai and Yu's study (2017). Individual innovation is the basis for organizational innovation, and keeping employees' sustainable power of innovation is an essential factor for enterprises to maintain a competitive advantage (Wu et al., 2016).

The association between ambidextrous leadership and employee innovation and between ambidextrous leadership and organizational innovation is also verified with the mediation roles of knowledge sharing and knowledge search factors. These results support the hypothesis that knowledge-sharing mediates relationships between ambidextrous leadership and employee innovation (H6). The results also align with earlier studies (Zhao et al., 2021; Haidar et al., 2023), which explore that employees' innovative work behavior increases when knowledge-sharing among them increases. Additionally, results confirmed that knowledge search mediates between ambidextrous leadership and organizational innovation (H7). These results align with earlier research (Jia et al., 2022), which finds that opening leaders tend to encourage their subordinates to seek opportunities from the constantly changing innovative environment and build a kind of atmosphere conducive to exploration knowledge search (Tolulope et al., 2020). Conversely, closing leaders enhance organizational innovation by inspiring employees to complete tasks conventionally and efficiently.

Nevertheless, based on the study of Jia et al. (2022), strategic flexibility can play a moderating role in the relationship between the search for exploitative knowledge and organizational innovation. The authors find out the reasons for this lack of confirmation and lack of alignment with the above study (Jia et al., 2022) investigating the following cases: (a). The field of Iran's high-tech companies, (b). Cultural differences between the cultures of the two societies of Iran and China, (c). Sanctions and economic conditions of Iran's domestic market. The existence of technology-based companies moves on the edge of the frontier of knowledge. As a result, search for knowledge has a flexible strategic orientation that transfers innovations to the organizational level, and it seems that this issue is less taken into consideration in Iran.



## 5 Conclusion

### 5.1 Managerial implications

Ambidexterity enables *leveraging* current conditions to optimize existing business model operations while *exploring* opportunities for groundbreaking innovation. For firms' rapid and sustainable growth, effective implementation of both facets of ambidextrous leadership is crucial, integrating operations research techniques into managerial strategies. Ambidexterity can reshape how businesses create value by simultaneously addressing operational inefficiencies and implementing leading practices within the current business model. Balancing short-term results with long-term strategic goals is essential for ambidextrous leadership. Managers must ensure that pursuing immediate gains does not compromise long-term innovation and organizational adaptability. In technology-based companies, managers should recognize the significance of ambidextrous leadership in fostering both exploitative (improving existing processes) and exploratory (innovative) activities. Encouraging leaders to balance these dual roles can cultivate a more innovative and adaptive organizational culture. Moreover, to enhance innovation outcomes, managers should actively promote knowledge sharing and knowledge search among employees. Creating platforms and incentives for employees to exchange ideas, experiences, and information can facilitate knowledge flow, leading to improve innovation. Furthermore, technology leaders and HR departments should invest in training programs focusing on developing ambidextrous leadership skills among managers. These programs should emphasize balancing exploration and exploitation, managing paradoxes, and fostering knowledge sharing within teams and the organization. Implementing recognition and reward systems that acknowledge employees' innovative efforts can motivate continuous learning, knowledge sharing, and creative problem-solving.

### 5.2 Theoretical implications

This research contributes to the existing literature on ambidextrous leadership by providing empirical evidence of its impact on employee and organizational innovation within technology-based companies. It also reinforces the importance of ambidextrous leadership in contemporary organizations and extends its application to the technology sector. Moreover, it highlights the mediating roles of knowledge sharing and knowledge search in the relationship between ambidextrous leadership and innovation outcomes. The study provides insights into how leadership practices influence innovation processes at multiple levels within technology-driven organizations by investigating the impact of ambidextrous leadership on employee and organizational innovation. It bridges the gap between leadership and knowledge management literature, demonstrating that ambidextrous leadership plays a pivotal role in facilitating knowledge sharing and knowledge search which, in turn, drives innovation.

The findings offer valuable insights for policymakers and practitioners in technology-based companies seeking to enhance innovation capabilities. The study underscores the significance of adopting ambidextrous leadership practices and cultivating knowledge-sharing environments to promote sustainable innovation.

### 5.3 Limitations and directions for future research

The research may face limitations regarding the sample size and the specific technology-based companies chosen for the study. A more extensive and diverse sample would enhance

the generalizability of the findings to the entire technology industry. The research's quantitative method adopts a cross-sectional design, which may limit its ability to establish causality between ambidextrous leadership, knowledge sharing, knowledge search, employee innovation, and organizational innovation. Thus a longitudinal study could provide more robust evidence of causality over time. The study may heavily rely on self-reported data, such as employee perceptions of leadership styles, knowledge sharing, and innovation. This introduces the possibility of response bias and social desirability bias, which could affect the accuracy and reliability of the results.

The research may not fully capture all relevant contextual factors that could influence the relationships between ambidextrous leadership, knowledge sharing, knowledge search, and innovation. Factors such as industry-specific characteristics, organizational culture, and external market conditions may significantly shape these relationships. While the study proposes knowledge sharing and knowledge search as mediators between ambidextrous leadership and employee/organizational innovation, it is vital to acknowledge the possibility of other mediating variables that could play but are not included in the model. By addressing these limitations and pursuing future research in these directions, the understanding of the role of ambidextrous leadership in fostering innovation and knowledge processes in technology-based companies can be enriched, leading to more actionable insights for organizational leaders and managers. Longitudinal studies would offer more robust insights into the dynamic nature of these relationships. In order to establish causal relationships, future research could employ longitudinal designs to track changes in ambidextrous leadership, knowledge sharing, knowledge search, and innovation over an extended period.

Quite often, technology-based companies have various hierarchical levels (individual, team, and organizational). Investigating ambidextrous leadership's impact on innovation and knowledge processes at different levels would provide a more comprehensive understanding of its effects within the organizational context. Combining quantitative data with qualitative data like interviews or focus groups could provide deeper insights into the underlying mechanisms and perceptions related to ambidextrous leadership, knowledge sharing, and innovation. Comparing technology-based companies across different industries and geographical locations could help identify how contextual factors influence the relationships between ambidextrous leadership, knowledge sharing, knowledge search, and innovation.

Further research could explore other potential mediators or moderators influencing the relationship between ambidextrous leadership and innovation outcomes. For example, factors like organizational culture, IT infrastructure, or employee characteristics might impact the effectiveness of ambidextrous leadership. Conducting experimental or quasi-experimental studies to implement interventions to enhance ambidextrous leadership behaviors and assess their impact on employee and organizational innovation could yield practical implications for technology-based companies. Comparing the effects of ambidextrous leadership with other leadership styles (e.g., transformational, transactional) on innovation outcomes would help identify the unique contributions of ambidextrous leadership in technology-based companies.

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**Data availability** Data are included in the manuscript.

## Declarations

**Competing interest** The authors declare that they do not have any conflict of interest.

**Ethical approval** This article does not contain any studies with human participants or animals performed by any authors.

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