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Balancing the Cognitive Highwire: The Effect of CEO–TMT Shared Cognition on Radical Innovation and Innovation Efficiency

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ABSTRACT

Radical innovation and innovation efficiency are important for a firm's competitive advantage. Past research has established that the firm's upper echelons disproportionately contribute to the radicalness and efficiency of innovation efforts. Relying on a social-interactionism view of the CEO–TMT interface, we study the effects of CEO–TMT shared cognition in the form of subconscious cohesion and collective thinking, which is understood as *relational adaptation at the group level* on firms' attainment of radical innovation and innovation efficiency. We test our hypotheses on firms listed in the S&P 500 for at least three consecutive years between 2005 and 2018 and find that CEO–TMT shared cognition positively affects firms' pursuit of radical innovation, up to a certain point, at which shared cognition negatively affects firms' pursuit of radical innovation. We posit that the positive effect persists due to increasing CEO–TMT cohesion and concomitant confidence in pursuing high-risk business endeavors. After a certain point, these positive effects are outweighed by the negative effect of groupthink, which limits divergent thinking and creativity. These effects differ for innovation efficiency, which increases linearly with CEO–TMT shared cognition and its effects on cohesion. Supplementary analyses on organizational slack further contextualize these findings. High-discretion slack may dampen the benefits of cohesion and confidence, while low-discretion slack appears to reinforce them. Our study develops the understanding of radical innovation and innovation efficiency, contributing to the literature on shared leadership at the CEO–TMT interface. It offers valuable insights for innovation decision-makers, guiding them on the path to achieving breakthrough innovations and innovation efficiency.

Chinese startup DeepSeek's launch of its latest AI models, which it says are on a par or better than industry-leading models in the United States at a fraction of the cost, is threatening to upset the technology world order. January 28th 2025, Reuters.

1 | Introduction

Developing radical innovations – new technologies in markets that are nonexistent or in existing markets that require drastic behavior changes[1] – is important for firms'

Summary

- Firms seeking to enhance radical innovation should aim for moderate shared cognition between the CEO and the other CxOs. At this level, relational adaptation fosters cohesion and builds confidence to pursue radical innovation. Beyond this, stronger alignment can lead to groupthink, suppress divergent thinking, and limit the attainment of radical innovations.
- Innovation efficiency improves consistently as CEO–CxO shared cognition increases. Strong relational adaptation promotes cohesion and supports confident, coordinated execution, especially in firms with tighter resource constraints.
- Because radical innovation and efficiency are optimized at different levels of shared cognition, firms must make a deliberate strategic choice. Efficiency-focused firms should foster strong relational adaptation. Firms targeting radical innovation should maintain moderate alignment. The right balance depends on strategic priorities and available resources.

competitive advantage (Hill and Rothaermel 2003; McDermott and O'Connor 2002), considering that it results in superior financial returns (Kyriakopoulos et al. 2016; Tellis et al. 2009). However, pursuing radical innovations is risky because it is costly and detrimental to innovation efficiency (McDermott and O'Connor 2002; Talke et al. 2010), defined as R&D expenditure in relation to innovation outcomes (Hirshleifer et al. 2013). Thus, firms must increasingly navigate the tension between innovating radically but efficiently, or risk being outpaced by competitors (Baptista 2025; Krishna 2025). As a result, recent innovation research focuses on the antecedents of radical innovation (Genin et al. 2023; Sund et al. 2021; Wilden et al. 2022), juxtaposed with innovation efficiency (Zhang et al. 2022). A prominent research stream within this focus stresses the chief executive officer's (CEO) (e.g., Acemoglu et al. 2022; Steinberg et al. 2022) and the top management team's (TMT) *cognition* (e.g., Heavey and Simsek 2017; Liu et al. 2022b; Zhou et al. 2024) as critical for seeking radical innovativeness efficiently.

However, current radical innovation research examines the cognition of these decision-making bodies in isolation, and while the CEO is ultimately responsible for outcomes of high-risk business decisions (Finkelstein et al. 2008; Nadkarni and Chen 2014), achieving radical innovation with an efficient resource investment involves the whole TMT (O'Connor and McDermott 2004; Wilden et al. 2022). Thus, we posit examining the ***shared cognition*** of all CxOs in the TMT. In the cognition literature, shared cognition in the form of subconscious cohesion and collective thinking is understood as *relational adaptation at the group level* (Georgakakis et al. 2022; Liu et al. 2022a). To date, the shared cognition of the CEO–TMT interface in relation to radical innovation and innovation efficiency has not been studied. However, CEO–TMT shared cognition may be pivotal for successful radical innovation, as it demands all operational functions, led by their respective CxOs, to innovate simultaneously (O'Connor and McDermott 2004; Wilden et al. 2022). Shared cognition may be equally vital for innovation efficiency, which requires all operational functions to align on the resource investments for innovation (Dewar and Dutton 1986; McDermott and O'Connor 2002). Thus, grasping CEO–TMT shared cognition may be essential for fostering a firm's successful realization of radical innovation and innovation efficiency.

We study the effects of CEO–TMT shared cognition—a form of relational adaptation—on firms' attainment of radical innovation and innovation efficiency. To this end, we rely on a social-interactionism view of the CEO–TMT interface, a derivative of the upper echelons theory, which posits that we need to examine the relational processes between the CEO and TMT to understand the outcomes of their actions (Bromiley and Rau 2016; Georgakakis et al. 2022). Especially shared cognition at the CEO–TMT interface is understood as a key factor that influences the quality of a firm's strategic decisions because CxOs circulate decisions throughout their functions (Liu et al. 2022a). Thus, we hypothesize that CEO–TMT shared cognition positively affects firms' pursuit of radical innovation up to a certain point. Beyond this point, CEO–TMT shared cognition negatively affects firms' pursuit of radical innovation. We posit that the positive effect persists due to the increasing relational adaptation of the CEO and TMT. However, after a certain point, these positive effects are offset by the negative effect of groupthink, limiting creativity and divergent thinking (Fleming et al. 2007; Ford 1996; LiCalzi and Surucu 2012; Thomas-Hunt et al. 2003), capabilities paramount for radical innovation (Anderson et al. 2014; Miron-Spektor et al. 2011). Contrasting radicalness and efficiency, we hypothesize that the effect of CEO–TMT shared cognition on efficiency is positive because the increasing relational adaptation of the team shifts a firm's focus on exploiting cost efficiencies (Eisenhardt and Schoonhoven 1990; Rovelli et al. 2020). Testing our hypothesis on 411 firms listed in the S&P 500 for at least 3 consecutive years between 2005 and 2018, we find support for our hypothesis. We assess shared cognition by adopting language style matching methods applied to quarterly earnings call transcripts of CxOs (e.g., Harrison and Malhotra 2024; Shi et al. 2019). To measure innovation radicalness and efficiency, we use a novel approach that measures the patents' technical novelty based on their text (Arts et al. 2021) and patent applications scaled by R&D expenditures (Zhong 2018).

Our study contributes to the literatures on radical innovation, innovation efficiency, and relational adaptation through CEO–TMT shared cognition. First, we extend research on innovation in relation to the cognition of CxOs (e.g., Chen and Nadkarni 2016; Gerstner et al. 2013; Wilden et al. 2022) by applying a social-interactionism view of the CEO–TMT interface (Georgakakis et al. 2022). We show that the relational adaptation processes that cultivate shared cognition among decision-makers influence innovation radicalness and efficiency. With the CEO–TMT interface gaining prominence in research on strategic decision quality (Finkelstein et al. 2008; Kurzhals et al. 2020), we show that it is also relevant with regard to research on innovation. Second, we extend research on CEO–TMT shared cognition by highlighting the detailed mechanisms of shared cognition that positively and negatively affect innovativeness. By contrast, prior work on CEO–TMT shared cognition has focused on ambidexterity (Cao et al. 2010; Chen et al. 2021b) and R&D intensity (Heyden et al. 2017). Finally, we contribute to the growing literature that juxtaposes innovation radicalness and efficiency as an alternate tradeoff to the radicalness-incremental duality. This tradeoff is important as firms pursue incremental and radical innovations simultaneously but often fail to accurately compute the tradeoffs between radicalness and cost efficiencies (Zhang et al. 2022). Our results show that while relational adaptation through shared cognition may align key decision-makers on efficiency, it can hinder radicalness after a certain point, which may create firm-specific tradeoff concerns and strategies to consider.

2 | Theory

2.1 | Upper Echelons, Radical Innovation, and Innovation Efficiency

Upper echelons theory posits that a firm's executives contribute disproportionally to the attainment of firm outcomes (Carpenter et al. 2004; Hambrick and Mason 1984). Research on firms' upper echelons, such as CEOs, TMT members, and board members, has empirically shown their strong influence on firms' innovation outcomes (Cortes and Herrmann 2021; Zhu et al. 2024).

Particular attention has been paid to the *CEO* as this position mentors other TMT members (Carpenter et al. 2004; Hambrick 2007; Hambrick and Mason 1984). Innovation research showed the importance of the CEO, as CEOs facilitate radical innovation through management sponsorship (Heyden et al. 2020; McDermott and O'Connor 2002; Slater et al. 2014) and inventor experience (Islam and Zein 2020). However, while CEOs with inventor experience drive innovation outcomes in terms of patents, citations, and R&D spending, they do not universally foster innovation efficiency (Byun et al. 2021). In addition, firms led by family CEOs demonstrate a unique ability to excel in radical innovation and effectively navigate resource constraints (Ardito et al. 2025).

Innovation research further shows that *individual members of the TMT* have distinct effects on firms' innovation. For instance, information systems research shows the positive roles of chief information officers (CIOs) and chief technology officers (CTOs) for (digital) innovation (Bendig et al. 2023; Chen et al. 2021a; Garms and Engelen 2019), and general management research focuses on the impact of chief operating officers (COOs) on patenting (Bendig 2022). Studies examining the impact of individual CxOs on innovation radicalness and efficiency remain limited.

In contrast, much attention has been paid to the *whole TMT*, a firm's highest operational decision-making body (Daily and Schwenk 1996). For instance, TMT research on firms' innovation posits that TMT cognition impacts firms' entrepreneurial orientation (Cho and Hambrick 2006), explorative innovation (Alexiev et al. 2010), R&D strategy (Kor 2006), and product launches (Boeker 1997). Importantly, research has shown that the growth aspirations and the change management effectiveness of the TMT are positively related to a firm's radical innovation (Eide et al. 2021). Similarly, TMTs' framing of iterative innovation processes as failures erodes ideas and reduces resources for radical innovation (Kratochvil 2025). In corresponding fashion, research has shown that TMT quality, measured through a composite index of experience and education, is positively related to innovation efficiency (Chemmanur et al. 2019).

2.2 | From an Upper Echelons View Toward a Social-Interactionism View on Innovation

2.2.1 | The CEO–TMT Interface, Radical Innovation, and Innovation Efficiency

A commonality of innovation radicalness and efficiency research is that CEOs or the TMT are studied in isolation, which overlooks the critical and unique dynamics of their interfacing decision-making processes (Bromiley and Rau 2016; Georgakakis et al. 2022; Kurzhals et al. 2020). Interfaces are particularly useful to extend upper echelons research because strategic leadership is a collective effort based on a nexus of relationships between executives and others (Simsek et al. 2018). One of the most salient interfaces is the nexus of the CEO and TMT (Bromiley and Rau 2016; Georgakakis et al. 2022; Ling et al. 2008; Peterson et al. 2003).

Extending upper echelons theory (Carpenter et al. 2004; Hambrick 2007; Hambrick and Mason 1984), the CEO–TMT interface explains how CEOs affect strategic behaviors and related outcomes through dynamics with the TMT (Chen et al. 2021c; Simsek et al. 2018). The CEO–TMT interface perspective suggests that CEOs, who are responsible for coaching and rewarding TMT members, have a disproportionate impact on shaping group dynamics, which in turn affects firms' strategic outcomes (Chen et al. 2021c; Corwin et al. 2021). A similar pattern emerges in general innovation research examining how CEO–TMT dynamics influence firms' pursuit of innovation. For instance, incongruent perceptions of exchange quality between CEOs and TMT members can undermine the success of business model innovation (Chen et al. 2024). Likewise, firms with CEOs who are adept at integrating the TMT's digital innovation knowledge are more successful in pursuing digital innovation (Firk et al. 2022).

This distinctive group dynamic is also important for the attainment of radical innovations and innovation efficiency because relational adaptation at the CEO–TMT interface is impactful when CxOs must operate in unison to make strategic changes (Simsek et al. 2018). For example, different combinations of CEO leadership styles and TMT dissent (Nijstad et al. 2014), as well as combinations of CEO structural positions and TMT learning (Wesemann et al. 2025), have a diverse impact on the attainment of radical innovations. Also, prior research finds that TMT connectedness, such as when the CEO appoints a higher ratio of the TMT members, is negatively related to innovation efficiency and riskiness (Agha et al. 2021).

2.2.2 | The Social-Interactionism Perspective of the CEO–TMT Interface

Social interactions within the TMT are the basis of firms' strategic decision-making (Westphal and Zajac 2013). However, because TMT interactions are not observable to outsiders (Pitcher and Smith 2001), early work on interfaces focused on TMT demographics to study social interactions and shared cognition among TMT members (Hambrick and Mason 1984; Shi et al. 2019). Recently, scholars advanced the idea that researchers should shift focus from studying demographics as proxies for shared cognition to studying instead the collective processing of information as it unfolds within interactions in the TMT (Hambrick 2007; Kaplan 2011).

The social-interactionism perspective of the CEO–TMT interface studies the collective processing of information in relation to shared cognition and relational adaptation. This perspective extends upper echelons theory, keeping with its core premise that upper echelons disproportionately affect firm outcomes and posing in addition that we must understand the relational adaptation processes of the CEO–TMT interface to understand its effect (Georgakakis et al. 2022). The social-interactionism perspective on the CEO–TMT interface examines micro-level behaviors through which CEOs and other executives interact (Georgakakis et al. 2022). According to this perspective, roles are socially defined and develop based on relational adaptation processes among individuals within a social entity (Biddle 1986; Raes et al. 2011). Consequently, roles are not predefined but are collectively shaped by the social expectations and responses of other executives. This adaptation includes cognitive, social, and behavioral processes (Georgakakis et al. 2022; Liu et al. 2022a). Focusing on shared cognition and its dynamics promotes in-depth insights into the CEO–TMT interface (Liu et al. 2022a).

One of the most recent approaches to understanding executives' cognition is to analyze the psycholinguistic features of unscripted responses (i.e., how they speak), for example, through behavioral and verbal mimicry (Shi et al. 2019). Shared cognition in the form of behavioral mimicry describes the adoption of the mannerisms of one's interacting partner (Chartrand and Lakin 2013), and verbal mimicry describes the mimicking of others' syntax, accent, and speech patterns (Shi et al. 2019). Such mimicry has significant social implications, including enhanced regard, affiliation, and empathy among participants (Lakin and Chartrand 2003). Behavioral and verbal mimicry facilitate trust and affinity, which increase the likelihood of successful negotiation (Maddux et al. 2008) and mirror interpersonal cohesion (Chartrand and Lakin 2013; Gonzales et al. 2010). Shi et al. (2019) find that high verbal mimicry among CEOs and CFOs leads to more integrated decision-making, which consequently results in more positive evaluations, higher compensation, and the increased likelihood of board membership for the CFO. To the authors' knowledge, no study has so far examined radical innovation and innovation efficiency through the social-interactionism perspective of the CEO–TMT interface. The next chapters clarify our hypotheses and the underlying mechanisms that explain the relationship between CEO–TMT shared cognition and the attainment of radical innovation and innovation efficiency.

2.3 | From Cohesion to Groupthink: Positive and Negative Links Between CEO–TMT Shared Cognition and Radical Innovation

Shared cognition constitutes relational adaptation at the group level that expresses itself in subconscious cohesion and group confidence (Georgakakis et al. 2022; Liu et al. 2022a). When group members adapt to each other, they find it easier to discuss problems, voice dissent, and suggest more risky alternatives. In contrast, the absence of CEO–TMT shared cognition can result in an intimidated TMT that lacks confidence to participate in decision-making, leading to maladjustments within firms' internal activities (Peterson et al. 2003). For instance, prior work on cohesion at the CEO–TMT interface finds that demographic homogeneity as a proxy for cognitive homogeneity can reduce social conflict (Amason 1996; Barsade et al. 2000) and increase group cohesiveness (Ancona and Caldwell 1992), which in turn fosters innovativeness (Bantel and Jackson 1989) and openness to change (Glick et al. 1993). Similarly, behavioral integration of the CEO–TMT interface increases firms' ambidexterity (Cao et al. 2010; Lubatkin et al. 2006).

Further, TMT members with shared cognition have more social interactions and communicate more frequently (Preston and Karahanna 2008; Shi et al. 2019). This dynamic is important as enhanced CEO–TMT interaction reduces information asymmetry (Oehmichen et al. 2017), facilitates the understanding of ambidextrous strategies (Cao et al. 2010), and, with increasing group identification, leads to more integrated CEO–TMT groups that can harness each other's knowledge more efficiently (Georgakakis et al. 2017). High-quality CEO–TMT exchanges increase mutual trust and empower the team to make substantial and long-lasting decisions (Lin and Rababah 2014). In the same vein, more familiarity between the CEO and TMT increases the propensity for risk-taking (Simsek 2007).

For attaining radical innovations specifically, a team's shared understanding of goals is paramount (Alexander and van Knippenberg 2014). For example, CIO-TMT shared understanding is a significant antecedent of strategic alignment on the role of information systems within the firm (Preston and Karahanna 2008). Further, unitary senior management backing—which requires a common understanding of the topic among the members—is vital for the attainment of radical innovation (Heyden et al. 2020; Slater et al. 2014). CxOs' backing is even more so because they shape a firm's culture (Slater et al. 2014) and because their commitment to novelty is critical for realizing radical innovation (Talke et al. 2011).

However, despite the body of work emphasizing the benefits of shared cognition, some studies reveal that the link between shared cognition and performance in general may not follow a linear pattern. In fact, both low- and high-performing teams have shown indicators of groupthink (Peterson et al. 1998). Moreover, when teams perceive their task through similar frameworks (i.e., being in a state of groupthink), they become less able to respond to changes in task requirements (Berman et al. 2002). Such a decrease in cognitive diversity can also hamper TMT members' creativity (Shin et al. 2012). Generally, there is broad support for the notion that limited cognitive diversity in teams limits divergent thinking and creativity (Fleming et al. 2007; Ford 1996; LiCalzi and Surucu 2012; Thomas-Hunt et al. 2003).

Thus, prior research indicates that some form of relational adaptation is important, but that full cohesion (i.e., groupthink) negatively impacts the attainment of change. Indeed, extreme pressures for unanimity in a group can cause decision-makers to censor any dissent, ignore information, and overestimate the chances of success (Janis 1982). For example, Cruz et al. (2010) show that a CEO's preferential evaluation of the TMT due to family membership reduces the effectiveness of contract-enforcing mechanisms, weakening the CEO's regulatory function. Particularly in the pursuit of radical innovation, some amount of divergent thinking and creativity is essential to uncover new opportunities (Anderson et al. 2014; Miron-Spektor et al. 2011). Divergent thinking may be limited by excessive conformity and relational adaptation when it reaches a point at which it culminates in groupthink.

In sum, considering both the positive and negative links between CEO–TMT shared cognition and radical innovation, we hypothesize that there is an *inverted U-shaped association* between CEO–TMT shared cognition and radical innovation. CEO–TMT shared cognition should be positively related to firms' attainment of radical innovation, *up to a certain point*. CEO–TMT shared cognition, at first, positively affects firms' attainment of radical innovation up to a certain point by increasing team cohesiveness and concomitant confidence to approve strategic changes. However, after a certain point, these positive effects are offset by the negative effect of groupthink, which limits divergent thinking and creativity, which are paramount for radical innovation. Excessive cohesiveness in the form of groupthink affects firms' attainment of radical innovation negatively. Taken together, beyond a certain level of CEO–TMT shared cognition, its positive effects on radical innovativeness (due to relational adaptation) are smaller than its negative effects (due to groupthink), leading to an overall negative effect on radical innovativeness.

Hypothesis 1. *The level of CEO–TMT shared cognition is related to firms' radical innovation output non-linearly, such that low and high levels of shared cognition are associated with a reduction of firms' radical innovation output, creating an inverted U-shaped effect.*

2.4 | CEO–TMT Shared Cognition and Innovation Efficiency

We expect that CEO–TMT shared cognition affects firms' innovation efficiency, defined as R&D capital in relation to innovation outcomes (Hirshleifer et al. 2013). Radical innovation is more costly to achieve and implement than incremental innovation, due to the required organizational changes in value creation and value capture (Dewar and Dutton 1986; McDermott and O'Connor 2002). Radical innovation also requires more time and resources than incremental innovation because the uncertainty of outcomes and barriers to implementation are higher (Talke et al. 2010). Thus, the focus on explorative and risky forms of innovation in general, and radical innovation specifically, is increasingly juxtaposed with the focus on innovation efficiency (Agha et al. 2021; Byun et al. 2021; Zhang et al. 2022). Indeed, incremental and radical innovation are not necessarily a trade-off, as firms have various organizational tools, such as structural separation or external partnerships, to engage in exploration and exploitation at the same time (Lavie et al. 2010). However, a clear trade-off between radicalness and efficiency exists, as a tolerance for failure is necessary for radical innovation but detrimental for innovation efficiency (Zhang et al. 2022).

All innovation projects require efficient resource allocation to drive innovation efficiency (Henderson and Cockburn 1996). When the firm's innovation trajectory is clearly demarcated, firms focus on its exploitation (Kaplan and Tripsas 2008; Tripsas 1997). In addition, when these trajectories are explicitly defined and straightforward to delegate, firms with behaviorally integrated CEO–TMT interfaces also reinforce the exploitation of current innovation trajectories (Rovelli et al. 2020). Teams with high shared cognition adhere to their proven business models and are less inclined to experiment compared to those with less cognitive alignment (Narayan et al. 2021). For teams with high levels of shared understanding, time-to-market and efficiency become more easily conceivable goals than innovativeness (Eisenhardt and Schoonhoven 1990).

As a result, strong cohesion through shared cognition narrows the innovation opportunities that managers consider (Mihalache et al. 2012) and reduces receptivity to external knowledge (Katz and Allen 1982). Shared cognition and consensus on goals encourage managers' collaborative and integrative behaviors (Pearce and Ensley 2004). More specifically, they alleviate conflicts over resource allocation and challenges in executing innovation projects, thereby helping to distinguish between short-term and long-term opportunities (Mihalache et al. 2012). Building on our theorization that firms tend to focus on exploiting existing trajectories, we expect that shared cognition between the CEO and TMT improves innovation efficiency by enabling decision-makers to allocate resources efficiently to exploitable output.

Hypothesis 2. *The level of CEO–TMT shared cognition is positively related to firms' innovation efficiency.*

3 | Method

3.1 | Sample

We test our hypotheses using data on firms listed in the S&P 500 for at least 3 consecutive years between 2005 and 2018. This sample selection ensures that we capture the time-lagged effects of TMT decision-making when studying innovation outcomes (Bendig et al. 2022; Galasso and Simcoe 2011). To create a panel dataset at the firm-year level, we collect data from several sources. First, we use quarterly earnings call transcripts from the Thomson Reuters Street Events database to measure the cognitive features of TMT members (Graf-Vlachy et al. 2020; Shi et al. 2019). Second, we identify radical technological innovations by leveraging a natural language processing (NLP) technique to exploit the technical information in patent documents (Arts et al. 2021). Following Arts et al. (2021), we include all patent titles, abstracts, and claims for granted US utility patents from the USPTO and PATSTAT databases.

Third, we define the firms' TMT as those senior executives listed in the firm's annual 10-K or proxy statements and collect information on TMT members' prior roles, firms, and industry experience, also using additional available public sources as needed, such as biographical data via popular business press sources, that is, Bloomberg (Crossland et al. 2014; Heyden et al. 2017). This comprehensive view of the firms' TMTs accounts for the influence of TMT heterogeneity on firm-level innovation

(Alexiev et al. 2010). Fourth, we collect financial data from the CRSP/Compustat Merged (CCM) database and data on firms' vertical integration (Frésard et al. 2020). As a result, our full sample without missing data includes 5661 observations of 411 unique S&P 500 firms. Due to the leading of the dependent variables, this sample is reduced to 3298 observations.

3.2 | Variables

3.2.1 | Dependent Variables

We use technological innovation novelty to assess radical innovation as it captures how much a firm pushes the technological frontier (Righi and Simcoe 2019). Following Arts et al. (2021), we measure *Innovation novelty* as the number of novel pairwise keyword combinations that appear for the first time in a patent's title, abstract, or claim.[2] This approach allows us to harness the technical content of patents. In contrast, measures like citations capture prior art without reflecting a patent's technical content, resulting in inaccurate and incomplete representations due to examiner variability and strategic behavior (Barber IV and Diestre 2022; Blind et al. 2009). Notably, novel keyword combinations significantly outperform traditional measures in identifying technological breakthroughs, as evidenced by awards such as the Nobel Prize or the National Medal of Technology and Innovation, making them a compelling indicator of radical innovations (Capponi et al. 2022). An example of a novel keyword combination is "inkjet printhead" as found in HP Inc.'s patent number US4677447 (Arts et al. 2021). Following studies on patent-based count variables (Tan et al. 2022) and considering the typical skewness of count variables (Arts et al. 2021), we log-transform *Innovation novelty* after adding one. To aggregate the variable at the firm-year level, we sum up *Innovation novelty* by firm-year. Consistent with prior work, we lead the variable by 2 years to account for the time that CEO–TMT characteristics and decisions may take to manifest in innovation activities (Galasso and Simcoe 2011).

We measure *Innovation efficiency* as a firm's number of patent applications in a year divided by its R&D capital and then multiplied by 100 to reflect the percentage points per firm as a continuous variable (Basse Mama 2018; Hirshleifer et al. 2013). Research indicates that the application year most accurately reflects the effective timing of innovation (Zhong 2018). The R&D capital represents the aggregated R&D expenditure over a 3-year period, with an annual depreciation rate of 1/3. The scaling of innovative outputs by R&D capital is based on the insight that R&D expenses incurred in preceding years collectively contribute to the successful filing of patent applications (Zhong 2018). We log-transform the variable after adding one and, in instances where data on innovation efficiency is not available, we assign a value of zero (Hirshleifer et al. 2018). Following related research, we lead the variable by 1 year (Zhong 2018).

3.2.2 | Independent Variables

To assess our explanatory variable, CEO–TMT *Shared cognition*, we use the CEO's and TMT members' discussions during earnings calls. In the question-and-answer (Q&A) section of earnings calls, company representatives take turns answering relatively unpredictable questions from analysts and investors. In contrast to other business documents like letters to shareholders or the "Management Discussion and Analysis" portion of Form 10-Ks, these responses are relatively spontaneous and unscripted, directly reflecting the executive's thinking style (Graf-Vlachy et al. 2020). To analyze the psycholinguistic features of the discussions, we leverage the language style matching (LSM) score developed by Ireland et al. (2011) and apply it to all TMT members in the Q&A. Thus, we analyze a category of words called function words (i.e., personal pronouns, impersonal pronouns, articles, auxiliary verbs, adverbs, prepositions, conjunctions, negations, and quantifiers) that have been shown to identify social psychological states within groups (Gonzales et al. 2010). Unlike content words that represent what individuals say (i.e., verbs, nouns), function words do not contain semantic information but capture how people unconsciously talk and think about a topic (Ireland and Pennebaker 2010; Ireland et al. 2011). As a result, function words and LSM are unaffected by the specific content of conversations, suggesting consistency across various decision-making contexts within the CEO–TMT interface. Consequently, our analysis of function words serves as a reliable indicator of the elusive shared cognition, capturing the underlying social dynamics of TMTs (Shi et al. 2019). An example can be found in Supporting Information: Appendix A.

To determine the LSM score for the TMTs, we first compared the Q&A respondents to the information collected on the TMTs and excluded all non-TMT members. Next, we used the LSM algorithm for groups (Gonzales et al. 2010) and calculated a score for each TMT member based on the use of the nine major function word categories (FWC) mentioned above using formula (1). Each score is then compared to the scores of the combined TMT using formula (2). For each group, the nine averaged, category-specific LSM scores calculated in step two are then averaged to obtain a total group LSM score. The final LSM score ranges from 0 to 1, where 1 represents a perfect function-word match between members of the TMT.

$$\textit{Member}\ \mathrm{LSM}_{\mathrm{FWC}} = 1 - \frac{|\,\mathrm{Member}_{\mathrm{FWC}} - \mathrm{TMT}_{\mathrm{FWC}}|}{(\,\mathrm{Member}_{\mathrm{FWC}} + \mathrm{TMT}_{\mathrm{FWC}} + 0.0001)}$$

$$\mathrm{TMT\ LSM}_{\mathrm{FWC}} = \frac{\sum_{i}^{n} \mathrm{Member\ LSM}_{\mathrm{FWC}}}{n}$$

3.2.3 | Control Variables

Our analyses incorporate a set of controls, including CEO-specific, TMT-wide (including the CEO unless otherwise noted), firm-level, and industry-level variables.

At the CEO level, we include a binary variable indicating *CEO duality*, as it enhances CEO positional power and can affect decision-making (Finkelstein 1992). Moreover, risk-taking behaviors may be influenced by CEO tenure and gender (Zhang et al. 2022). Consequently, we include controls for *CEO tenure*, measured in years, and *CEO gender*, coded as 1 for female and 0 for male. Similarly, we control for TMT members' average tenure

(*TMT tenure*) and TMT gender composition (*TMT share male*), both excluding the CEO.

TMT heterogeneity impacts managerial decision-making and innovation (Heyden et al. 2012). Accordingly, we control for the size of the TMT and its total compensation. *TMT size* is measured most inclusively by the total number of managers listed in Form 10-K or proxy statements, a firm's annual filings with the Securities Exchange Commission (SEC) (Bendig 2022). *TMT compensation* is the total compensation including cash, bonuses, and incentives, as these can influence managerial risk preferences (Galasso and Simcoe 2011). To capture the influence of TMT human capital, we also include *TMT career variety*, measured as the average sum of different industry sectors, companies, and functional roles in which TMT members worked before joining the TMT of the focal company (Crossland et al. 2014). Furthermore, to account for differences in the innovation behavior of externally hired TMT members (Cummings and Knott 2018), we control for the *TMT share of outsiders*, measured as the average of TMT executives who were promoted from outside the company to their current position.

At the firm level, we control for *Firm size* (logarithm of total assets), *Firm age* (logarithm of listing year), and *firm performance* (net profit), as research suggests that size, age, and performance are determinants of TMT behavior (Bakker and Josefy 2018; Carpenter and Sanders 2002; Harrison et al. 2024). In addition, we control for *R&D intensity, Advertising intensity*, and *Capital intensity* to account for the firm's strategic orientation and financial constraints. R&D (advertising) intensity is measured as the firm's R&D (advertising) expenditures scaled by total assets (Chatterjee and Hambrick 2007). Missing values are replaced with zeros, and a dummy variable is included for missing cases of R&D expenditures, creating the dummy variable *R&D missing* (Blagoeva et al. 2020; Koh and Reeb 2015). *Capital intensity* is operationalized as capital expenditures scaled by total assets. To capture governance conditions, we also control for a firm's *Vertical integration* by including the vertical network industry relatedness score (Frésard et al. 2020). In addition, we control for the sentiment of each earnings call Q&A (*Call sentiment*) by measuring the average negative tone (Cohn et al. 2004) and also account for the average number of TMT members participating in the Q&A portion of the earnings call (*TMT Q&A participation*).

At the industry level, we control for *Industry dynamism*, as dynamic and unstable environments are characterized by a greater need for technological innovation (Jansen et al. 2006). Industry dynamism was operationalized as instability in market demand and measured as volatility in industry sales (3-digit SIC level) over the past five years (Dess and Beard 1984). Correspondingly, we extracted the standard errors of the regression coefficients from the year dummies after regressing industry sales over five years against year dummies and divided them by the mean industry sales (Connelly et al. 2013; Malhotra and Harrison 2022).

To conclude, in regressions on *Innovation novelty* ($t+2$), we introduce the dependent variable *Innovation novelty* ($t+1$) with a one-year lead as a control variable, as firms that discover breakthrough inventions are influenced in their subsequent pursuit of breakthrough inventions (Ahuja and Lampert 2001). While this does not aid causal identification, it is an important control variable that helps to avoid overestimating coefficients, likely leading us to estimate the lower bounds of the effect (Bellemare et al. 2017). Given that we are interested in within-firm effects, we include firm and year fixed effects to control for time-invariant and year-specific unobserved heterogeneity. In line with prior work, we also winsorize all continuous variables at the 1st and 99th percentiles to ensure that outliers do not influence our results (Kogan et al. 2017).

3.3 | Estimation Method

We analyze *Innovation novelty* ($t+2$) and *Innovation efficiency* ($t+1$) as a function of CEO–TMT *Shared Cognition* and *Shared Cognition squared*. To do so, we estimate fixed effects OLS models with robust standard errors clustered at the firm level using Stata 18. In addition, we take steps to alleviate endogeneity concerns. Our primary concern regarding endogeneity is that our sample is limited to observations with multiple CxOs engaging in the Q&A sessions of earnings calls. To alleviate endogeneity concerns from selection, we re-estimate our main models using a variant of Heckman's two-step procedure (Certo et al. 2016; Clougherty et al. 2016; Heckman 1979).

In the first step, we specify a selection equation predicting the probability of earnings calls with CxOs engaging in the Q&A (probit). We use the estimates of our selection model to calculate the inverse mills ratio (*IMR*), which we include in the second stage fixed effects OLS models to correct the selection bias. Our dependent variable for the first stage, *Q&A Engagement*, is a binary variable, taking the value of 1 for firm years with CxOs engaging in the Q&A section of earnings calls and 0 otherwise. In line with research leveraging earnings calls to examine CEO cognition, we select a set of factors possibly related to selection (Harrison and Malhotra 2024; Malhotra and Harrison 2022). At the CEO–TMT level, we include *CEO tenure*, *CEO duality*, the average age of the TMT and CEO (*TMT average age*), *TMT career variety*, *TMT share of outsiders*, and *TMT size*. At the firm level, we include *Firm size*, because larger firms often have a greater number of CxOs who are more exposed to outside stakeholders, as well as industry dummies (2-digit), because different industries may have different conventions in relying on CxOs in such calls.

Reiterating the need for an instrument in Heckman procedures (Wolfolds and Siegel 2019), we include the *Number of analysts' recommendations* in the first stage probit, measured by the log of the annual mean of the number analysts' recommendations received by a firm, according to the I/B/E/S database (Benner and Ranganathan 2012). We predict that the *Number of analysts' recommendations* is positively related to *Q&A Engagement* because information demands increase with analysts' recommendations, which likely leads to increased CxO engagement (Huang et al. 2018). In addition, prior research indicates that analysts' recommendations are not directly linked to a firm's radical innovation or innovation efficiency (Benner 2010). Our data support these predictions: the *Number of analysts' recommendations* is a strong predictor of selection into the sample ($\beta=0.77$; $p=0.004$), but it does not predict *Innovation novelty* ($t+2$) or *Innovation efficiency* ($t+1$). The correlation between the *IMR* and our measure of *Shared cognition* is −0.05, significantly below the threshold of |0.30|, indicating an effective two-stage procedure and a reasonably good choice of exclusion restriction (Certo et al. 2016).

4 | Results

4.1 | Main Results

Table 1 presents the descriptive statistics and the correlation matrix. The dependent variables *Innovation novelty* ($t+2$) (mean = 3.64, skewness = 0.44) and *Innovation efficiency* ($t+1$) (mean = 0.66, skewness = 1.4), as well as the independent variable *Shared cognition* (mean = 0.57, skewness = −0.41) are slightly skewed, but not so much as to be of concern. Following Kalnins (2018) guidelines for addressing multicollinearity issues, we inspect the influence of all variables correlated above 0.2 with the independent variable. Separate regressions, excluding these variables, show consistent signs and magnitudes, suggesting that multicollinearity is unlikely to distort the results (Supporting Information: Appendix B, Model 6 and 7).

Table 2 presents the results from the fixed effects OLS models predicting *Innovation novelty* ($t+2$) (Models 1–3) and *Innovation efficiency* ($t+1$) (Models 4–6). Model 1 only includes controls. The *IMR* is negative and statistically significant throughout all models predicting radical innovation (lowest estimate Model 2: $\beta = -0.37$; $p = 0.060$), indicating that a selection has occurred (Clougherty et al. 2016). The results of the first stage selection equation can be found in Supporting Informatation: Appendix C. We find no effect of *Shared cognition* on *Innovation novelty* ($t+2$) in Model 2 ($\beta = 0.14$; $p = 0.471$) when we only account for the direct effect of *Shared cognition*. Thus, no linearly positive or negative effect is inferred. Model 3 presents the results with the inclusion of the *Shared cognition squared* for *Innovation novelty* ($t+2$). We find a positive and significant effect of *Shared cognition* ($\beta = 1.87$; $p = 0.007$) and a negative and significant effect of *Shared cognition squared* ($\beta = -1.64$; $p = 0.009$) on *Innovation novelty* ($t+2$). The results indicate that there is an inverted U-shaped relationship between CEO–TMT shared cognition and radical innovation. This provides initial evidence for hypothesis 1.

To probe the inverse U-shaped relationship between CEO–TMT shared cognition and radical innovation, we follow the three-step procedure outlined by Lind and Mehlum (2010) and refined by Haans et al. (2016). Three conditions must be met to formally establish an inverse U-shape. First, both coefficients must be statistically significant and of the expected opposite sign. Second, the slope at both ends of the data range needs to be sufficiently steep. In addition, with both slope tests significant, in our case, the slope for the left-hand side of the data range needs to be positive and must be negative for the right-hand side. Third, the extreme point of the curve must be located well within the data range.

Our estimated models fulfill the first condition. To ascertain the remaining conditions, we use the Stata u-test module (Lind and Mehlum 2010). We determine the maximum point for *Innovation novelty* ($t+2$) (0.568). Next, we inspect the slope tests and the overall test for the presence of an inverse-U shape. We find all results significant and of the expected sign (t-value = 2.31; $p = 0.011$). Finally, we estimate the 95% confidence intervals of the turning points using the Fieller method and find the turning point is located within range ($0.43 < 0.56 < 0.80$) (Haans et al. 2016). Following Haans et al. (2016), we further test the robustness of the quadratic relationship and add a cubic term (*Shared Cognition cubic*) to Model 3 to determine if an S-shape would offer a better model fit. The cubic term does not improve model fit.

Figure 1 visualizes the inverse U-shape using the parameters of the fully specified fixed-effects model. The graph confirms the presence of an inverse U-shape. Figure 2 depicts predictive margins at low and high values of *Shared cognition*. Consistent with convention, we use values at one and two standard deviations below and above the mean to reflect the low and high values of *Shared cognition*. Increasing from low (−1SD) to mean and increasing from mean to high (+1SD), *Shared cognition* is related to a 6.5% increase and a 6.2% decrease in *Innovation novelty* ($t+2$).

Turning to Models 4–6, Table 2 presents the results from the fixed effects OLS models predicting *Innovation efficiency* ($t+1$). Model 4 only includes the control variables. The *IMR* is negative and statistically significant throughout all models predicting the relationship between *Shared cognition* and *Innovation efficiency* ($t+1$) (lowest estimate Model 5: $\beta = -0.15$; $p = 0.096$), reiterating the selection effect. Model 5 presents the results for *Shared cognition* on *Innovation efficiency* ($t+1$) ($\beta = 0.21$; $p = 0.018$), indicating that *Shared cognition* positively affects *Innovation efficiency* ($t+1$). Model 6 presents the results with the inclusion of the *Shared cognition squared* for *Innovation efficiency* ($t+1$). We find no effect of *Shared cognition squared* ($\beta = 0.03$; $p = 0.917$) on *Innovation efficiency* ($t+1$), indicating that the effect of *Shared cognition* on *Innovation efficiency* ($t+1$) is linearly positive and not curvilinear. This provides support for hypothesis 2. In economic terms, increasing from low (−1SD) to high (+1SD) *Shared Cognition* is associated with an 8.41% increase in *Innovation efficiency* ($t+1$).

4.2 | Supplementary Analyses

In addition to our main analyses, we conduct a supplementary examination of organizational slack, recognizing its role in shaping radical innovation within firms (e.g., Troilo et al. 2014).[3] We distinguish between two types of slack, liquidity (i.e., high-discretion available slack) and long-term borrowing capacity (i.e., low-discretion potential slack), to assess their distinct impacts on innovation dynamics (Hambrick and D'Aveni 1988; McClelland et al. 2010). Available slack is measured using the current ratio (current assets/current liabilities), while potential slack is operationalized through the firm's inversed long-term debt to asset ratio (long-term debt/total assets) (O'Brien and David 2014). Our findings from Table 3, Model 2, demonstrate that higher levels of available slack flatten the inverse U-shaped relationship between *Shared cognition* and *Innovation novelty* ($t+2$) (β Shared

TABLE 1 | Descriptives and correlation matrix of the second stage sample.

	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Innovation novelty ($t+2$)	3.64	3.98	1.00																								
2	Innovation efficiency ($t+1$)	0.66	1.12	0.65	1.00																							
3	Innovation novelty ($t+1$)	3.62	3.97	0.92	0.65	1.00																						
4	Shared cognition	0.57	0.20	0.00	−0.06	−0.01	1.00																					
5	Shared cognition sq.	0.36	0.21	0.01	−0.06	0.00	0.97	1.00																				
6	CEO duality	0.68	0.47	0.06	0.00	0.06	−0.02	0.00	1.00																			
7	CEO tenure	5.95	5.72	−0.07	−0.03	−0.08	−0.03	−0.01	0.12	1.00																		
8	CEO gender	0.97	0.17	0.00	0.02	−0.01	−0.04	−0.03	0.01	0.08	1.00																	
9	TMT tenure	3.94	2.37	−0.10	−0.05	−0.10	−0.05	−0.04	0.10	0.29	0.07	1.00																
10	TMT share male	0.85	0.14	−0.02	0.05	−0.02	−0.08	−0.08	−0.02	0.02	0.03	0.10	1.00															
11	TMT size	9.78	3.80	0.16	0.10	0.16	0.06	0.06	0.10	−0.09	−0.04	−0.08	−0.05	1.00														
12	TMT compensation	5405.57	3788.96	0.25	0.11	0.26	0.08	0.10	0.12	0.11	−0.05	0.04	−0.12	0.07	1.00													
13	TMT career variety	5.97	1.25	0.04	0.03	0.04	0.03	0.01	−0.12	−0.05	−0.05	−0.18	−0.08	−0.34	0.06	1.00												
14	TMT share outsiders	0.30	0.24	−0.03	−0.01	−0.03	0.02	0.03	−0.12	0.04	0.00	0.05	−0.03	−0.09	−0.02	0.22	1.00											
15	Firm size	9.75	1.36	0.09	−0.10	0.09	0.23	0.24	0.16	−0.09	−0.04	−0.09	−0.12	0.28	0.48	−0.13	−0.16	1.00										
16	Firm age	3.12	0.47	0.05	0.09	0.06	−0.07	−0.07	0.11	0.00	0.01	0.08	0.04	0.17	0.05	−0.19	−0.23	0.17	1.00									
17	Firm performance	1552.91	3723.43	0.25	0.08	0.25	0.08	0.09	0.07	−0.01	−0.02	−0.04	−0.06	0.11	0.44	−0.04	−0.10	0.41	0.08	1.00								
18	R&D intensity	0.02	0.04	0.58	0.44	0.57	−0.04	−0.05	−0.12	−0.01	0.05	−0.08	0.05	−0.04	0.05	0.15	0.11	−0.22	−0.06	0.03	1.00							
19	R&D spending missing	0.46	0.50	−0.49	−0.54	−0.49	0.10	0.10	0.02	−0.02	0.05	0.05	0.02	−0.07	−0.07	−0.03	−0.06	0.28	−0.02	−0.04	−0.49	1.00						
20	Advt intensity	0.01	0.03	0.05	−0.02	0.06	0.00	0.01	0.01	0.03	−0.04	0.01	−0.13	0.04	0.02	0.08	0.05	−0.21	−0.04	0.00	0.03	−0.15	1.00					
21	Capital intensity	0.04	0.04	−0.12	−0.05	−0.13	−0.18	−0.19	0.02	0.03	0.02	0.02	0.03	−0.09	−0.06	0.03	−0.12	−0.18	0.09	−0.07	−0.07	0.07	0.06	1.00				
22	Vertical integration	0.01	0.01	0.13	0.19	0.12	−0.19	−0.18	0.03	−0.07	0.02	−0.02	0.10	0.07	−0.07	−0.15	−0.15	−0.12	0.19	−0.04	−0.03	−0.15	−0.11	0.12	1.00			
23	Call sentiment	0.31	0.14	0.04	0.01	0.04	0.03	0.02	−0.01	0.02	0.06	0.05	0.04	−0.01	−0.03	−0.11	−0.02	0.00	0.00	−0.01	0.08	−0.04	0.04	−0.16	−0.02	1.00		

(Continues)

TABLE 1 Continued

	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
24	TMT Q&A participation	3.39	1.88	−0.25	−0.25	−0.25	0.15	0.09	0.03	0.03	−0.02	0.02	−0.06	0.17	0.00	−0.15	−0.06	0.33	−0.09	−0.02	−0.20	0.23	−0.15	−0.20	−0.25	0.00	1.00	
25	Industry dynamism	0.03	0.02	−0.12	−0.10	−0.13	0.00	0.01	−0.01	−0.03	0.05	−0.01	0.03	−0.02	−0.07	−0.05	−0.02	0.05	−0.12	−0.06	−0.14	0.25	−0.10	0.10	0.06	−0.03	0.07	1.00
26	IMR	0.31	0.41	−0.09	−0.05	−0.09	−0.07	−0.07	−0.02	−0.05	0.03	0.13	0.07	−0.18	−0.23	0.14	0.19	−0.32	−0.10	−0.13	−0.02	0.05	0.11	0.14	0.04	0.02	−0.17	0.11

Note: $N = 3298$ firm-year observations of 411 firms.

cognition squared X Available slack = 1.87; $p = 0.005$), whereas potential slack steepens it (ß Shared cognition squared X Potential slack = −1.62; $p = 0.043$).[4] Further, the analysis of *Innovation efficiency* ($t+1$) in Table 3, Model 4, suggests that available slack negatively moderates the relationship between *Shared cognition* and *Innovation efficiency* ($t+1$) (ß Shared cognition X Available slack = −0.18; $p = 0.098$). In contrast, the moderating effect of potential slack is positive, though insignificant (ß Shared cognition squared X Potential slack = 0.16; $p = 0.131$). We discuss these results further in the discussion section of the manuscript.

4.3 | Robustness Test

To increase confidence in our results, we perform several additional analyses that vary the operationalization of the dependent variables, the operationalization of the independent variable, as well as specific choices in terms of sample and regression specifications. We generally vary the fully specified model for each dependent variable (Table 2, Models 3 and 6).

4.3.1 | Varying the Dependent Variables

We vary the dependent variables in several ways. Regarding *Innovation novelty* ($t+2$), we first weigh the dependent variable by the number of subsequent patents reusing these combinations to reflect the diffusion and impact of the innovation (Arts et al. 2021). Examining this second facet of radical innovation is important, as a core tenet of innovation research is to evaluate innovation based on its novelty, value-generating properties, and successful implementation (McDermott and O'Connor 2002). Consistent with our expectations, the findings from Model 1 (Table 4) indicate that the relationship between shared cognition and the weighted innovation novelty measure also follows an inverted U-shape (Shared cognition: ß = 2.13; $p = 0.006$; Shared cognition squared: ß = −1.86; p = 0.007). As before, we tested these results using the three-step procedure outlined by Lind and Mehlum (2010) and Haans et al. (2016), confirming the presence of an inverted U-shape relationship. Regarding *Innovation efficiency* ($t+1$), to further validate the robustness of our analysis, Model 5 (Table 4) explores an alternative specification. This model measures R&D capital as the average R&D expenditure over a 3-year period concluding in year *t* (Harrison et al. 2024). The results are qualitatively consistent (Shared cognition: ß = 0.24; $p = 0.026$).

Second, we do not log-transform *Innovation novelty* ($t+2$) and use the count variable with fixed effects Poisson models with robust standard errors instead (Table 4, Model 2). Such models are suggested in management and finance research instead of manually transforming the dependent variable (Cohn et al. 2022; Rönkkö et al. 2022). This is also in line with the original count variable put forward by Arts et al. (2021). We do the same for *Innovation efficiency* ($t+1$) (Table 4, Model 6) but retain the fixed effects OLS as it is a continuous variable. The results remain robust.

Third, we bootstrap our main model over both the first and second stages of Heckman's two-step procedure (1500

TABLE 2 | FE OLS regression predicting innovation novelty ($t+2$) and innovation efficiency ($t+1$).

	(1)	(2)	(3)	(4)	(5)	(6)
	FE	FE	FE	FE	FE	FE
Dependent variable	**Novelty**	**Novelty**	**Novelty**	**Efficiency**	**Efficiency**	**Efficiency**
Shared cognition		0.14	1.87		0.21	0.17
		(0.471)	(0.007)		(0.018)	(0.620)
Shared cognition squared			−1.64			0.03
			(0.009)			(0.917)
CEO duality	−0.18	−0.18	−0.19	−0.01	−0.01	−0.01
	(0.085)	(0.085)	(0.082)	(0.787)	(0.774)	(0.775)
CEO tenure	0.01	0.01	0.01	0.00	0.00	0.00
	(0.213)	(0.206)	(0.159)	(0.258)	(0.223)	(0.224)
CEO gender	0.12	0.12	0.14	0.05	0.05	0.05
	(0.666)	(0.659)	(0.615)	(0.455)	(0.416)	(0.419)
TMT tenure	0.00	−0.00	−0.00	−0.01	−0.01	−0.01
	(0.997)	(0.991)	(0.945)	(0.502)	(0.468)	(0.471)
TMT share male	0.07	0.07	0.04	0.15	0.14	0.15
	(0.779)	(0.794)	(0.888)	(0.277)	(0.298)	(0.296)
TMT size	0.00	0.00	0.00	−0.00	−0.00	−0.00
	(0.929)	(0.915)	(0.968)	(0.667)	(0.704)	(0.706)
TMT share outsiders	0.06	0.07	0.09	0.02	0.03	0.03
	(0.751)	(0.722)	(0.618)	(0.859)	(0.775)	(0.779)
TMT compensation	−0.00	−0.00	−0.00	0.00	0.00	0.00
	(0.813)	(0.795)	(0.754)	(0.174)	(0.192)	(0.193)
TMT career variety	0.04	0.03	0.03	0.00	0.00	0.00
	(0.495)	(0.507)	(0.508)	(0.903)	(0.948)	(0.948)
Firm size	0.41	0.41	0.42	−0.15	−0.15	−0.15
	(0.009)	(0.009)	(0.007)	(0.042)	(0.041)	(0.040)
Firm age	−0.52	−0.53	−0.52	0.26	0.25	0.25
	(0.264)	(0.255)	(0.260)	(0.116)	(0.130)	(0.131)
Firm performance	−0.00	−0.00	−0.00	−0.00	−0.00	−0.00
	(0.212)	(0.230)	(0.208)	(0.184)	(0.182)	(0.182)
R&D intensity	−4.15	−4.15	−4.14	−5.23	−5.23	−5.23
	(0.421)	(0.421)	(0.421)	(0.009)	(0.009)	(0.009)
R&D spending missing	−0.36	−0.37	−0.36	−0.28	−0.29	−0.29
	(0.266)	(0.258)	(0.272)	(0.058)	(0.054)	(0.053)
Advt intensity	8.61	8.57	8.98	−1.92	−1.97	−1.98
	(0.095)	(0.095)	(0.072)	(0.387)	(0.359)	(0.356)
Capital intensity	−0.52	−0.54	−0.63	−0.70	−0.72	−0.72
	(0.703)	(0.694)	(0.645)	(0.393)	(0.380)	(0.382)

(Continues)

TABLE 2 Continued

	(1)	(2)	(3)	(4)	(5)	(6)
	FE	FE	FE	FE	FE	FE
Dependent variable	**Novelty**	**Novelty**	**Novelty**	**Efficiency**	**Efficiency**	**Efficiency**
Vertical integration	9.63	9.59	9.67	−5.98	−6.03	−6.03
	(0.236)	(0.237)	(0.232)	(0.092)	(0.086)	(0.086)
Call sentiment	−0.12	−0.13	−0.16	−0.08	−0.09	−0.09
	(0.606)	(0.596)	(0.502)	(0.358)	(0.330)	(0.335)
TMT Q&A participation	−0.04	−0.04	−0.06	0.00	0.00	0.00
	(0.277)	(0.286)	(0.119)	(0.970)	(0.870)	(0.853)
Industry dynamism	2.86	2.85	2.89	−0.08	−0.10	−0.10
	(0.078)	(0.079)	(0.072)	(0.899)	(0.882)	(0.881)
Innovation novelty ($t+1$)	0.25	0.25	0.25			
	(0.000)	(0.000)	(0.000)			
IMR	−0.37	−0.37	−0.36	−0.15	−0.15	−0.15
	(0.061)	(0.060)	(0.065)	(0.105)	(0.096)	(0.096)
Constant	0.42	0.36	−0.02	0.90	0.83	0.83
	(0.801)	(0.826)	(0.990)	(0.282)	(0.319)	(0.311)
Firm and year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3298	3298	3298	3298	3298	3298
F statistic	13.06	12.28	12.18	4.54	4.45	4.32
R^2 (within)	0.13	0.13	0.14	0.15	0.15	0.15

Note: Models 1–3 present the second stage of the selection model with *Innovation novelty* ($t+2$) as the dependent variable. Models 4–6 repeat the same for *Innovation efficiency* ($t+1$). p values are in parentheses. All models include clustered, robust standard errors.

bootstrap repetitions) to correct for possibly biased standard errors (Clougherty et al. 2016; Wooldridge 2013). The results remain robust for *Innovation novelty* ($t+2$) (Table 4, Model 3) and *Innovation efficiency* ($t+1$) (Table 4, Model 7). Finally, in Model 4 (Table 4) we report results from random-effects ordered logistic regressions using terciles of *Innovation novelty* ($t+2$) (Briggs 2015). The results show that our inferences remain unchanged under these alternative model specifications.

4.3.2 | Varying the Independent Variable

We vary the independent variable in two important ways. First, we conduct dyadic analyses of the LSM between CEOs and TMTs, comparing the CEO against the aggregated TMT. Results remain stable in this analysis (Table 5, Models 1 and 3), which shows that our results are not influenced by idiosyncratic aggregations of the LSM score. We still chose the aggregated LSM for the overall TMT as our main operationalization, as it is most in line with the theoretical conceptualization of relational adaptation and shared cognition at the CEO–TMT interface.

Second, we conduct a subsample analysis of the CEO–CFO dyad, which is frequently featured in earnings calls (Shi et al. 2019) and to which researchers attribute a distinct dynamic as the CFO is often a strategic partner of the CEO (Harrison and Malhotra 2024). We theorize that the CEO–CFO dynamic should be less prominent, however, because the radicalness and efficiency of innovations often rely on the whole TMT to collaborate, rendering single roles less important. Thus, we expect the effects in this subsample analysis to be smaller. In line with our reasoning, such a CEO–CFO based analysis does not yield significant results (Table 5, Models 2 and 4), reinforcing our team-based perspective.

4.3.3 | Varying General Sample and Variable Specifications

To increase confidence in our choices that affect all variables, we check whether we introduced bias through general variable and sample operationalizations. First, we check for bias introduced by winsorization (McDonald and Allen 2022) and perform all tests both without winsorization of continuous variables and with winsorization at the 5th and 95th percentiles. The results are robust for both specifications (Supporting Information: Appendix B, Models 1–4). Second, we examine our main analyses when excluding the leading dependent variable (*Innovation novelty* ($t+1$)) to ascertain if our downward adjustment created potential autocorrelation. Results excluding the variable

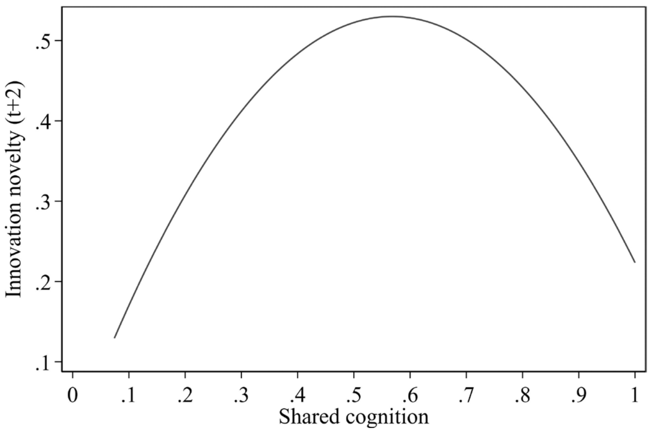

FIGURE 1 | Regression plots for innovation novelty ($t+2$) (Table 2, Model 3). The panel depicts the regression results for the shared cognition–innovation novelty relationship.

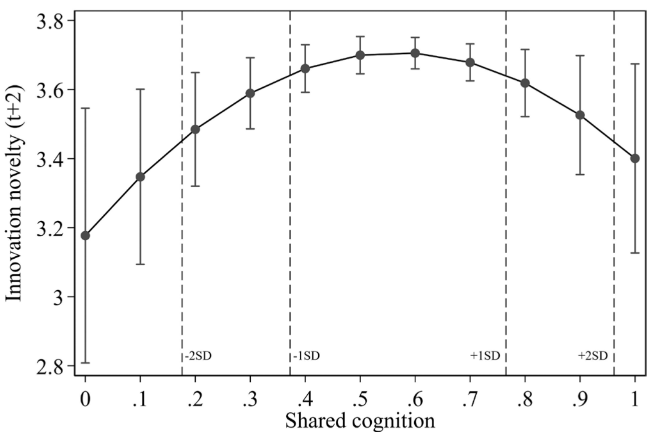

FIGURE 2 | Marginal effects for innovation novelty ($t+2$) (Table 2, Model 3). The panel depicts the marginal effects for the shared cognition–innovation novelty relationship.

remain robust (Supporting Information: Appendix B, Model 5). Third, we address concerns about sample attrition in our two-stage design. Supporting Information: Appendix C contains the results of the first-stage selection equation, while Supporting Information: Appendix D contains *t*-tests comparing the first-stage sample with the second-stage sample. The results show that attrition does not significantly affect the distribution of our dependent and independent variables except for *Innovation efficiency* ($t+1$). We re-examine the main models without all variables affected by attrition, and our results are robust for *Innovation novelty* ($t+2$) (Table 6, Model 1) and *Innovation efficiency* ($t+1$) (Table 6, Model 4). In addition, we rerun the main model for *Innovation efficiency* ($t+1$) without leading the dependent variable (Table 6, Model 3) to address potential attrition concerns shown in Supporting Information: Appendix B, Model 3. Results remain robust. Fourth, we estimate random effects models with year and industry-fixed effects (1-digit SIC). The results are in line with the fixed-effects models regarding direction and size for *Innovation novelty* ($t+2$) (Table 6, Model 2) and *Innovation efficiency* ($t+1$) (Table 6, Model 5). This suggests that our findings are consistent, whether considering within-firm or between-firm effects.

Taken together, our results provide support for our hypothesis under various alternative specifications and transformations. This provides further evidence for an inverted U-shaped effect between CEO–TMT shared cognition and firms' attainment of radical innovation, as well as a linear effect of shared cognition on firms' innovation efficiency.

5 | Discussion

CxO cognition is an important antecedent of a firms' innovation outcomes in general (Cortes and Herrmann 2021; Zhu et al. 2024) and of radical innovation and innovation efficiency specifically (Zhang et al. 2022). Extending this line of work, we study CEO–TMT shared cognition as a form of *relational adaptation at the group level*, which manifests as subconscious cohesion and collective thinking (Georgakakis et al. 2022; Liu et al. 2022a). Such shared cohesion is particularly important for successful radical innovation and innovation efficiency because both require operational functions, led by their respective CxOs, to innovate in unison with efficiently allocated resource investments (McDermott and O'Connor 2002; O'Connor and McDermott 2004).

We hypothesize and find that CEO–TMT shared cognition positively affects firms' pursuit of radical innovation up to a certain point. Beyond this point, CEO–TMT shared cognition negatively affects firms' pursuit of radical innovation. We posit that the positive effect persists due to the increasing relational adaptation of the CEO and TMT. However, after a certain point, these positive effects are offset by the negative effect of groupthink (LiCalzi and Surucu 2012), limiting creativity and divergent thinking, which are paramount for radical innovation (Anderson et al. 2014; Miron-Spektor et al. 2011). More concretely, we find that a one standard deviation increase (decrease) of shared cognition from the sample mean is associated with an increase of 6.5% (decrease of 6.2%) in innovation novelty. Given that the optimal shared cognition value (0.568) is very close to the sample mean (0.57), this is a meaningful change for the average firm and its changes in shared cognition over time. This also provides further evidence that our effects are not driven by outliers and likely reflect the average firm. This is also comparable to recent work, which shows (1) a 13.5% increase in radical patent counts for one standard deviation increase in board experiential diversity, measured as a combination index of various demographic characteristics (Genin et al. 2023) and (2) a 12.8% increase in firm patents associated with an interquartile range increase in top management quality, measured as an index of educational and work experiences (Chemmanur et al. 2019). In sum, our findings indicate that CEO–TMT shared cognition is a meaningful construct, which helps to explain an economically significant proportion of radical innovation outcomes.

Contrasting innovation radicalness and efficiency, we hypothesize and find that the effect of CEO–TMT shared cognition on efficiency is positive because increasing relational adaptation of the team shifts a firm's focus on exploiting cost efficiencies (Eisenhardt and Schoonhoven 1990; Rovelli et al. 2020). More concretely, we find that a one standard deviation increase in shared cognition is associated with an 8.41% increase in innovation efficiency, which is qualitatively similar in size to the

TABLE 3 | FE OLS regression: available and potential slack moderation.

	(1)	(2)	(3)	(4)
	FE	FE	FE	FE
Dependent variable	**Novelty**	**Novelty**	**Efficiency**	**Efficiency**
Shared cognition	2.13	2.39	0.27	0.24
	(0.007)	(0.003)	(0.004)	(0.008)
Shared cognition squared	−1.77	−1.99		
	(0.014)	(0.006)		
Available slack	0.00	−0.31	−0.09	0.00
	(0.983)	(0.136)	(0.028)	(0.962)
Potential slack	0.03	0.43	0.02	−0.07
	(0.805)	(0.061)	(0.705)	(0.376)
Shared cognition X Available slack		−1.91		−0.18
		(0.010)		(0.098)
Shared cognition squared X Available slack		1.87		
		(0.005)		
Shared cognition X Potential slack		1.55		0.16
		(0.048)		(0.131)
Shared cognition squared X Potential slack		−1.62		
		(0.043)		
Constant	−0.97	−0.97	0.01	0.06
	(0.561)	(0.560)	(0.992)	(0.952)
Main model controls	Yes	Yes	Yes	Yes
Firm and year FE	Yes	Yes	Yes	Yes
Observations	2621	2621	2621	2621
F statistic	11.27	10.12	4.93	4.70
R^2 (within)	0.14	0.15	0.19	0.20

Note: Models 1 and 2 present the slack analysis of the selection model with *Innovation novelty* ($t+2$) as the dependent variable. Models 3 and 4 repeat the same for *Innovation efficiency* ($t+1$). The main explanatory variable included in the interactions is standardized. The sample size decreases due to some missing data on organizational slack. *p* values are in parentheses. All models include clustered, robust standard errors.

results of Chemmanur et al. (2019) for their top management quality index. This suggests that shared cognition, while controlling for multiple indicators of CxO quality and demographic characteristics, provides an additional and novel factor to consider when studying innovation efficiency.

5.1 | Theoretical Implications

We extend research on innovation in relation to the cognition of key executives (Gerstner et al. 2013; Wilden et al. 2022) by applying a social-interactionism view of the CEO–TMT interface (Georgakakis et al. 2022). We show that beyond isolated decision-making bodies, the relational adaptability processes that cultivate shared cognition among key decision-makers significantly influence radical innovation and innovation efficiency. With the CEO–TMT interface gaining prominence in research on strategic decision quality (Finkelstein et al. 2008; Kurzhals et al. 2020), we contribute by starting to unpack the micro-mechanisms that influence this decision quality. We show how relational adaptation unfolds through verbal mimicry (Shi et al. 2019) and to what extent this affects outcomes such as innovation radicalness and efficiency. In prior research, such adaptation processes at executive interfaces are often mostly studied one-sidedly as behavioral integration—which is perceived to be unilaterally positive, creating a "teamness" (Simsek et al. 2018) – neglecting that adaptability can also have downsides in the form of groupthink. We show that relational adaptability may also have unintended consequences that researchers at the CEO–TMT interface need to be aware of, limiting the upsides of behavioral integration and similar expressions of group level adaptability. Considering the previously mentioned economic significance of our effects, such groupthink is likely to be impactful.

TABLE 4 | Robustness tests: alternative specifications of the dependent variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE	FE	FE	FE	FE	FE
Dependent variable	**Impact**	**Novelty**	**Novelty**	**Novelty**	**Efficiency**	**Efficiency**	**Efficiency**
Shared cognition	2.13	0.59	1.87	4.68	0.24	2.06	0.21
	(0.006)	(0.006)	(0.007))	(0.011)	(0.026)	(0.003)	(0.021)
Shared cognition squared	−1.86	−0.54	−1.64	−3.70			
	(0.007)	(0.004)	(0.009)	(0.030)			
Innovation novelty ($t+1$)		0.06	0.25				
		(0.000)	(0.000)				
Innovation novelty weighted (t + 1)	0.24						
	(0.000)						
Innovation novelty ordered (t + 1)				1.93			
				(0.000)			
Constant	0.97		−0.02		0.55	25.21	0.83
	(0.586)		(0.988)		(0.586)	(0.001)	(0.291)
Main model controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm and year FE	Yes	Yes	Yes	No	Yes	Yes	Yes
Observations	3298	2113	5976	3298	3298	3298	5976
Log-likelihood	—	−3570.17	—	−1235.71	—	—	—
Chi-square	—	945.69	366.61	1535.50	—	—	182.26
F statistic	12.50	—	—	—	4.69	2.84	—
R^2 (within)	0.14	—	0.13	—	0.16	0.11	0.14

Note: Bootstrapping without drops for Models 3 and 7, and these models display the Adjusted R^2. Model 1 includes lagging DV *Innovation novelty weighted* ($t+1$) as control and Model 4 *Innovation novelty ordered* ($t+1$). Model 4 also includes year and industry dummies. p values in parentheses. Models include clustered, robust standard errors.

Further, we extend research on CEO–TMT shared cognition by studying the innovativeness of firms and by highlighting the detailed mechanisms of shared cognition that positively and negatively affect innovativeness. Prior work on CEO–TMT shared cognition has focused on ambidexterity (Cao et al. 2010; Chen et al. 2021b) and R&D intensity (Heyden et al. 2017) but has focused on different mechanisms. Examples include mechanisms based on structural properties of CEO–TMT interfaces such as functional complementarity and power decentralization (Cao et al. 2010), or on the temporal orientation (i.e., short-term vs. long-term) of the CxOs (Chen et al. 2021b). We extend such work by examining different types of innovation outcomes (i.e., innovation radicalness and efficiency) and by highlighting a different underlying mechanism, which is CEO–TMT shared cognition. In detailing how relational adaptation leads to shared cognition and under which circumstances this elicits team cohesiveness and concomitant confidence, or conversely, groupthink, we offer new avenues to reexamine prior findings in related contexts. Given that only 5% of current strategic leadership studies addressed the CEO–TMT interface (Cortes and Herrmann 2021), uncovering the behavioral mechanisms at this interface still offers ample areas for contribution and contextualization of existing research findings on isolated CxOs, such as cognitive flexibility (Kiss et al. 2020) or proactiveness (Kiss et al. 2022) as a team.

In addition, our supplementary analyses on organizational slack further contextualize the impact of CEO–TMT shared cognition on innovation. We find that readily available high-discretion slack may undermine the positive influences of group cohesion and exacerbate the negative impacts on concomitant confidence, which potentially hinders radical innovation. In other words, the executives of highly liquid firms have less reason to radically change their liquidity-generating business as usual. In contrast, low-discretion potential slack appears to strengthen the positive effects of group cohesion and alleviate the adverse impacts on concomitant confidence. Additionally, available slack seems to reduce efficiency gains in innovation. These insights contextualize our findings and underscore the importance of organizational slack as a critical boundary condition for the firm's innovation capability (Troilo et al. 2014).

Finally, our results contribute to the growing literature that juxtaposes innovation radicalness and efficiency, as an alternative tradeoff to the well-known radicalness-incremental duality. While successfully pursuing radical innovation generates

TABLE 5 | Robustness tests: alternative specifications of the independent variable.

	(1)	(2)	(3)	(4)
	FE	FE	FE	FE
Dependent variable	**Novelty**	**Novelty**	**Efficiency**	**Efficiency**
Shared cognition	1.47	−3.13	0.21	0.14
	(0.026)	(0.350)	(0.009)	(0.383)
Shared cognition squared	−1.25	2.22		
	(0.038)	(0.330)		
Constant	−0.41	2.45	0.79	0.46
	(0.804)	(0.270)	(0.350)	(0.603)
Main model controls	Yes	Yes	Yes	Yes
Firm and year FE	Yes	Yes	Yes	Yes
Observations	3176	2946	3176	2946
F statistic	12.15	11.82	4.41	4.32
R^2 (within)	0.14	0.13	0.15	0.16

Note: Model 1 and 3 show results for the CEO–TMT dyadic analyses. Models 2 and 4 show results for the CEO–CFO interface. *p* values are in parentheses. Models include clustered, robust standard errors.

TABLE 6 | Robustness tests: general sample and variable specifications.

	(1)	(2)	(3)	(4)	(5)
	FE	FE	FE	FE	FE
Dependent variable	**Novelty**	**Novelty**	**Efficiency**	**Efficiency**	**Efficiency**
Shared cognition	1.82	1.41	0.18	0.21	0.25
	(0.009)	(0.025)	(0.064)	(0.017)	(0.004)
Shared cognition squared	−1.60	−0.95			
	(0.011)	(0.100)			
Constant	3.45	−1.34	−0.18	−0.42	−0.69
	(0.011)	(0.013)	(0.829)	(0.358)	(0.052)
Main model controls	Yes	Yes	Yes	Yes	Yes
Firm and year FE	Yes	No	Yes	Yes	No
Industry and year FE	No	Yes	No	No	Yes
Observations	3298	3298	4197	3298	3298
F statistic	16.67	—	4.93	5.08	—
R^2 (within)	0.13	0.10	0.17	0.15	0.14

Note: p values in parentheses. Models 1 and 4 exclude controls affected by attrition. *p* values in parentheses. Models include clustered, robust standard errors.

superior financial returns (Kyriakopoulos et al. 2016; Tellis et al. 2009), it is costly and therefore often detrimental to innovation efficiency (McDermott and O'Connor 2002; Talke et al. 2010). This tradeoff is essential as firms pursue incremental and radical innovations simultaneously but often fail to accurately compute the tradeoffs between radicalness and cost efficiencies (Zhang et al. 2022). Our results show that while relational adaptation through shared cognition can align key decision-makers on efficiency, it may hinder radicalness beyond a certain point, potentially creating firm-specific tradeoff considerations and strategies. Theoretically, depending on the strategy of a firm and on the external stakeholder demands the firm is facing, there may be different local optima in terms of radicalness and efficiency. Firms that aim to instill long-term investor confidence may have to balance both according to the imminent needs of their key stakeholders.

5.2 | Managerial Implications

Our findings suggest various optimization strategies for firms. While low levels of shared cognition appear to be negatively associated with innovation radicalness and efficiency in comparison with both medium and high levels of shared cognition, medium and high shared cognition each have their distinct advantages. Medium levels of shared cognition are associated with high radical innovation and medium innovation efficiency, whereas high shared cognition is associated with medium radical innovation and high innovation efficiency. An intriguing question arises: Should firms lean toward maximizing radical innovation or focus their efforts on maximizing innovation efficiency?

We propose that the resolution of this question depends on a firm's strategic orientation. While low shared cognition seems to be unfavorable in any case, firms willing to optimize radical innovation may seek to balance shared cognition and divergent cognition within the CEO–TMT interface. Medium shared cognition reflects a limited relational adaptation at the CEO–TMT level, which means that senior executives mutually understand one another and have built a certain level of trust, but still scrutinize each other's viewpoints and engage in active debate (Shi et al. 2019). Such an environment may ensure strategic decision-making flexibility while simultaneously cultivating productive interactions that balance the need for organizational innovation and efficiency in innovating.

In contrast, firms willing to optimize innovation efficiency may seek to develop a strong shared cognition within the CEO–TMT interface. Given that radical innovation is especially costly to obtain (Talke et al. 2010), such a focus may help to reduce costs in the innovation process and lessen problems of resource scarcity. Firms with cash constraints may especially favor such an approach. This balancing act should be orchestrated in concert with the resource availability of the firm, as our supplementary analyses show that organizational slack alters the relationship between shared cognition and both radical innovation and innovation efficiency. Firms with high-discretion slack may experience fewer benefits from shared cognition, as senior executives may not perceive a need for radical innovation and efficiency, potentially becoming overconfident in their current trajectories in a liquidity-abundant firm. Conversely, firms that maintain low-discretion potential slack may not only enhance their innovation efficiency but also create a focused, resource-rich firm conducive to the pursuit of radical innovation. Contextualizing these considerations in the current AI debate, IBM CEO Arvind Krishna rightfully states that the innovation race with AI is not going to be focused on the largest and best AI models only, but on who will be able to provide novel and impactful AI models efficiently (Krishna 2025).

Extending our arguments with novel research at the CEO–TMT interface, firms may have two prominent pathways to manage relational adaptation at this level: executive hiring and board oversight. Prior work shows that narcissistic CEOs prefer to appoint TMT members that are equally narcissistic, creating more homogeneous CEO–TMT interfaces (Junge et al. 2024). Thus, on the one hand, firms that wish to create a strong shared cognition (i.e., optimizing efficiency) should allow the CEO to appoint TMT members that are like her and that she feels a strong connection with. On the other hand, firms that wish to create a medium shared cognition (i.e., optimizing radicalness) should exert more board oversight on the TMT member appointment process. Not only do boards play their own role in the attainment of radical innovation (Genin et al. 2023), they also play a pivotal role in ensuring CEO–TMT decision-making resonates with the firm's innovation objectives (Robeson and O'Connor 2013). We suggest a new role for the corporate board: managing the level of shared cognition and relational adaptation of the CEO–TMT interface for the desired level of radical innovation and innovation efficiency.

5.3 | Limitations and Directions for Future Research

Our study is not without limitations. First, our study focused on the CEO–TMT interface and shared cognition between those organization members (e.g., Chen et al. 2021c; Georgakakis et al. 2022; Ling et al. 2008). While the interface of key decision-makers is an important one, other interfaces of executives and their effects on radical innovation and innovation efficiency should be considered in future studies. For example, CEO–board interfaces (Shen 2003; Westphal and Zajac 1995) and TMT-middle manager interfaces (Raes et al. 2012, 2011) have been found to influence firms' transformation efforts (Simsek et al. 2018). Yet, results of the relational adaptation of actors at such interfaces may differ because of the various frequencies and intensities of interaction between the actors. Future studies should examine the extent to which other interfaces influence decision-making regarding radical innovation and innovation efficiency.

Second, our study focused on the juxtaposition of radical innovation and innovation efficiency, which constitute only a part of firms' innovation activities. While radical innovation and innovation efficiency are important cornerstones of the innovation literature (e.g., Chemmanur et al. 2019; Kaplan 2008; Mitchell and Singh 1993; Tripsas 1997; Zhang et al. 2022), other types of innovativeness, such as overall innovation output and R&D investments, are also important predictors of firms' sustained competitive advantage (Gimenez-Fernandez et al. 2020; Grillitsch and Schubert 2021). Thus, future work should focus on exploring the effects of CEO–TMT shared cognition on different types of innovation or creativity, which would further enrich our knowledge of the effects of relational adaptation at this specific interface in relation to innovation outcomes.

Finally, our study focuses on established and mature organizations. While we posit that our results are generalizable to other contexts, we may find different effects in samples of ventures. In such contexts, CEO and TMT changes are frequent (Boeker and Karichalil 2002; Boeker and Wiltbank 2005), and business model pivots or other transformative strategic initiatives are conducted without the alignment of firm executives (Grimes 2018; Hampel et al. 2020). Thus, while early studies on the importance of TMT alignment have found that it is important for ambidexterity of small and medium enterprises (Lubatkin et al. 2006), future research is needed to verify whether it is the same for innovativeness in general and radical innovativeness and efficiency specifically. In a similar vein, we encourage scholars to examine different countries and cultures, as prior work indicates that national culture may affect firms' approach to radical innovation (Tellis et al. 2009) and CEO–TMT interaction (Ling et al. 2015).

Ethics Statement

The authors have read and agreed to the Committee on Publication Ethics (COPE) international standards for authors.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available through commercial licenses from third party vendors. Sharing is restricted through the vendor.

Endnotes

[1] Scholars also use the term discontinuous technology instead of radical innovation to refer to technological innovations (e.g., Anderson and Tushman 1990). For a discussion of the terminology, please see Weber et al. (2019).

[2] For a detailed discussion on cleaning of patent text and creation of variables, please see Arts et al. (2021).

[3] We want to thank an anonymous reviewer for this suggestion.

[4] We find no evidence of a turning point shift.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.