The Double-Edged Sword Effect of Protracted Rivalry on Decision-Makers' Innovation Recognition and Its Mechanisms of Cognitive Depth and Breadth

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Abstract

Amidst fierce competition, decision-makers' ability to accurately identify innovation solutions that align with organizational needs is critical to enterprise survival and development. Decision-makers' innovation identification has emerged as a focal topic in organizational creativity and innovation research. However, existing studies on innovation identification have overlooked the significant impact of competitive factors among decision-makers, failing to fully elucidate decision-makers' cognitive biases and the underlying mechanisms that produce such biases. In the process of enterprise innovation, decision-makers often engage in prolonged contests with opponents in adjacent domains and of comparable strength, where ordinary competition evolves into archrivalry. In light of this, the present project adopts a theoretical perspective of archrivalry to investigate how competition between decision-makers influences the accuracy of innovation identification for both parties. The project plans to integrate multiple research methods, including laboratory and field experiments and archival analysis, to design four studies that examine the positive and negative effects of archrivalry on decision-makers' innovation identification, reveal the mediating role of cognitive processing depth and breadth pathways, and explore boundary conditions at the decision-maker–decision-maker dyadic level. By approaching from the perspective of inter-decision-maker competition, this research promises to more accurately diagnose biases in decision-makers' innovation identification and the internal mechanisms underlying these biases, thereby assisting decision-makers in better understanding and guarding against such biases.

Full Text

The Double-Edged Sword Effect of Rivalry on Decision-Makers' Innovation Recognition: The Mechanisms of Cognitive Depth and Breadth

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Abstract: Amidst intense competition, the precise recognition of innovative solutions aligned with enterprise needs emerges as paramount for a company' s survival and growth. Decision-makers' creativity recognition holds a central position in the literature on organizational creativity and innovation. However, existing studies often overlook the substantial impact of competition, leaving decision-makers' cognitive biases and the underlying mechanisms unexplored. Consequently, research findings lack the explanatory power necessary for real-world phenomena. Within the corporate innovation process, decision-makers frequently engage in prolonged competition with closely matched opponents, transforming routine competition into enduring rivalry. Acknowledging this context, the current project adopts a relational competition perspective to investigate how rivalry between decision-makers influences the accuracy of creativity recognition for both parties. Employing a mixed-method approach encompassing laboratory experiments, field studies, and archival analysis across four studies, the project explores the nuanced effects of rivalry on decision-makers' creativity recognition. Furthermore, the project seeks to unveil the mediating roles of cognitive processing depth and breadth while examining boundary conditions at the decision-maker dyad level. Leveraging the rivalry perspective, this project sheds new light on decision-makers' cognitive biases in creativity recognition and the underlying mechanisms contributing to these biases. In terms of practical implications, this project can also assist decision-makers in comprehending and mitigating biases effectively.

Keywords: creativity and innovation, creativity recognition, competition, rivalry, leadership

1. Problem Statement

Competition is ubiquitous in business history and serves as a fundamental driver of corporate innovation (Correa & Ornaghi, 2014). Two startups founded in 2015—Mobike in January and ofo in August—pioneered and propelled China' s

bike-sharing industry forward (Guo & Yang, 2017). From their inception, both founders viewed each other as arch-rivals, engaging in fierce competition. Both established the identical strategic objective: defeating the other to become the undisputed leader in China' s bike-sharing market. By 2017, with clear relative advantages, the industry had evolved into a duopoly, with both parties believing that victory over the other would guarantee success. Consequently, the two companies engaged in a tit-for-tat innovation race across hardware, software, marketing, publicity, and daily operations, regardless of cost. However, this intense innovation competition failed to help either party grow stronger; instead, it accelerated their decline and eventual collapse—Mobike was acquired and its brand disappeared entirely, while ofo went bankrupt with numerous user deposits still unrefunded (Xu et al., 2019).

In leading enterprises to navigate fierce competition through innovation, gain relative advantages, and pursue long-term development, decision-makers' most critical responsibility is identifying innovation directions and models that align with organizational reality (Zhou et al., 2019; Bai et al., 2019). Although research on decision-makers' innovation recognition has accumulated substantial findings (Zhou et al., 2019; Qi et al., 2019), existing studies have overlooked the important influence of competitive factors, leading to a disconnect between research and management practice to some extent. Corporate innovation is always competitive, with parties innovating across technology, products, marketing, customer service, process management, and other dimensions while dynamically interacting between offense and defense, thereby temporarily gaining relative advantages in intense market competition (Chen, 1996; Chen & Miller, 2012). As with the competition between Mobike and ofo, when competing parties operate in similar domains, remain highly visible to each other, possess comparable strength, and engage in prolonged entanglement, they easily view each other as rivals, and previous ordinary competition may evolve into rivalry (Kilduff et al., 2010). Once escalated to rivalry, competition outcomes acquire significant psychological meaning, with both parties' primary goal becoming whether they can outperform the other rather than ensuring they obtain optimal returns (Converse & Reinhard, 2016; Kilduff & Galinsky, 2017; Kilduff et al., 2016).

In highly competitive environments, decision-makers' ability to accurately identify innovation solutions needed by the enterprise determines corporate survival. Existing research finds that decision-makers often exhibit innovation recognition bias—highly novel ideas frequently fail to gain approval and are instead rejected (Criscuolo et al., 2017; Mueller et al., 2012; Mueller et al., 2018; Mueller et al., 2014; Zhou et al., 2017). Decision-makers certainly need to accurately identify highly novel ideas with long-term value; otherwise, their enterprise may be disadvantaged in future innovation competition. However, decision-makers should also guard against overestimation bias—if defeating a rival becomes the primary decision-making objective, overestimating the effectiveness of one' s own innovative solutions and hastily adopting them will also lead to serious consequences. Simultaneously, decision-makers must guard against neglect bias, including tun-

nel vision resulting from excessive focus on rivals' movements—that is, overly concentrating on rival-related information leads to narrow vision (Posavac et al., 2010), thereby overlooking high-potential innovations outside that field of view. On the other hand, rivalry may also produce positive effects. To defeat a rival, decision-makers must comprehensively examine their own innovation strategies, and this focused cognition can help them scrutinize their innovation approaches. Although many researchers believe that entanglement with rivals causes people to act rashly without careful consideration (Converse & Reinhard, 2016; Malhotra, 2010), rivalry may also enhance decision-makers' innovation recognition efficiency and accuracy when identifying and evaluating innovation strategies. However, no study has systematically examined how competitive factors, especially rivalry, affect decision-makers' innovation recognition. Whether such effects exist and whether they are positive or negative remain largely speculative.

Given this, the current project argues that research on decision-makers' innovation recognition urgently needs to incorporate competitive factors to systematically reveal the potential effects of competing with rivals. Priority research questions include: Does entanglement with rivals affect decision-makers' innovation recognition? Does it lead to more recognition bias or improved recognition accuracy, or both? How does rivalry influence decision-makers' innovation recognition? What are the important moderating factors? This project proposes that incorporating competitive factors into the research framework promises significant theoretical and practical value. At the theoretical level, approaching from the unique perspective of rivalry can help identify unique innovation recognition decision biases and reveal the underlying mechanisms causing these biases. At the practical level, understanding corporate leaders' innovation decision-making processes from a competitive perspective can enhance decision-makers' awareness of innovation recognition biases, enabling them to consciously avoid and guard against such biases.

2.1 The Importance of Decision-Makers' Innovation Recognition

Organizational creativity and innovation research focuses on the processes and outcomes of developing, introducing, and implementing novel and valuable ideas, products, services, workflows, and solutions in workplace settings (Amabile, 1988; Anderson et al., 2014; Perry-Smith & Mannucci, 2017). Some scholars focus on the idea generation stage (George, 2007; Woodman et al., 1993; Zhou & Hoever, 2014), while others emphasize the idea implementation stage, noting that only when novel ideas are applied to actual workflows and produce substantive impact can true innovation be achieved (Baer, 2012; West, 2002; Li & Yang, 2016; Dong & Wang, 2020). Despite differences in focus, both perspectives share the commonality of understanding organizational innovation from the creator' s viewpoint.

However, regardless of how innovative employees' ideas or solutions may be,

they cannot enter the implementation phase without decision-makers' recognition and support. This is because any organization' s innovation resources are limited, and decision-makers must select a small number of ideas they deem most promising to advance to subsequent innovation stages, where they may succeed after multiple rounds of trial and iterative refinement (Stevens & Burley, 1997). In other words, decision-makers' innovation recognition serves as the decisive gate between idea generation and implementation, representing a critical link in launching substantive organizational innovation. Only ideas that gain decision-maker approval can receive subsequent support (Zhou et al., 2019; Bai et al., 2019).

During the innovation recognition phase, the most challenging task facing corporate decision-makers is accurately identifying ideas that are typically only in embryonic form and have not yet fully revealed their potential value, thereby gaining a first-mover advantage in fierce innovation competition. The logic is clear: products based on high-quality ideas can significantly stimulate consumer purchase intentions, with post-launch sales increasing by as much as 50% (Kornish & Ulrich, 2014); invention patents originating from novel ideas are also more likely to inspire high-level subsequent inventions (Packalen & Bhattacharya, 2015). Conversely, severe bias in decision-makers' innovation recognition can produce immeasurable potential negative impacts on corporate innovation. For instance, if an originally subpar idea is identified as a high-quality project and advanced, not only will innovation goals fail to be achieved, but organizational innovation resources and timing that could have generated greater benefits will be wasted. It should be noted that decision-makers do not deliberately ignore, belittle, or reject highly novel ideas; these behaviors often stem from unconscious avoidance of decision-making dilemmas (Mueller et al., 2012; Mueller et al., 2018). Precisely because of this, decision-makers need to consciously examine their own innovation recognition processes (Hill et al., 2021); otherwise, they are prone to making mistakes unknowingly and find it difficult to correct them.

2.2 Research Progress on Decision-Makers' Innovation Recognition

Over the past decade, organizational creativity and innovation researchers have shifted their perspective from creators to decision-makers, examining how decision-makers identify and judge the quality of others' ideas (Zhou et al., 2019; Bai et al., 2019). In the organizational innovation process, decision-makers at all levels essentially serve as gatekeepers, with their recognition outcomes determining whether employees' ideas can be accepted into subsequent innovation stages (Bai et al., 2019). This represents the core viewpoint of the systems perspective on creativity (Csikszentmihalyi, 1999): any innovative achievement results from the interaction of three subsystems—individual, domain, and field. In organizational innovation, creators, decision-makers, and enterprises correspond to these three subsystems: creators contribute prelimi-

nary innovation outputs and become the objects of decision-makers' innovation recognition; the enterprise' s innovation accumulation and environment provide action guidance and innovation support for both. Drawing on this systems perspective, this project summarizes research progress on decision-makers' innovation recognition (see Figure 1). Next, it first summarizes the main biases in decision-makers' innovation recognition processes, then introduces how characteristics of the three subsystems (creator, decision-maker, and environment) affect decision-makers' innovation recognition, and finally briefly reviews synergistic effects between subsystems.

[Figure 1: see original paper] Decision-Makers' Innovation Recognition from a Systems Perspective [Based on: Qi, Bai, & Lin. (2019). Keen insight: Research status and future directions of creativity recognition. *Foreign Economics & Management*, 41(7), 42–57.]

2.2.1 Cognitive Biases in Decision-Makers' Innovation Recognition

The core issue in innovation recognition research is whether decision-makers can accurately identify and endorse highly innovative ideas. Based on the literature reviewed, decision-makers typically cannot. Instead, decision-makers' innovation recognition frequently exhibits bias (Mueller & Yin, 2021; Qi et al., 2021). The most common and costly recognition bias is underestimation bias, where the most promising highly novel ideas are often incorrectly rejected in the initial stage (Boudreau et al., 2016; Criscuolo et al., 2017). This recognition bias is ubiquitous: audiences typically dislike movies with very high novelty (Luan & Kim, 2022); investors dislike companies they hold shares in emphasizing creativity and innovation too much (Haselhuhn et al., 2022); research projects based on cutting-edge disciplinary thinking increasingly struggle to gain favor from research funding agencies (Packalen & Bhattacharya, 2020); even editors of top academic journals reject highly innovative research findings (Siler et al., 2015).

Multiple factors contribute to innovation recognition bias (Mueller & Yin, 2021; Qi et al., 2021). First, people may hold implicit biases against highly novel ideas (Mueller et al., 2012). That is, although verbally supporting innovation, people often associate creativity/innovation with negative characteristics (e.g., risk, loss) at the implicit level. Second, people typically rely on concrete thinking to evaluate novel ideas, focusing cognitive processing on identifying shortcomings (e.g., high uncertainty, imperfect solutions, low familiarity) rather than employing abstract thinking to understand their potential value (Duan et al., 2022; Mount et al., 2021; Mueller et al., 2014). Third, others' high-quality ideas can threaten evaluators' selves (Menon et al., 2006), triggering knowledge territory protection awareness (Boudreau et al., 2016; Huo et al., 2018), ultimately hindering acceptance of highly novel ideas (Antons & Piller, 2015; Katz & Allen, 1982). Finally, innovation recognition is essentially associative evaluation, requiring people to connect novel target stimuli with elements of existing knowledge structures (Zhou et al., 2017). However, highly novel ideas are generally difficult to categorize within existing knowledge frameworks and may

even challenge consensus and mainstream paradigms, making them difficult to identify and evaluate.

2.2.2 Impact of Subsystem Characteristics on Decision-Makers' Innovation Recognition

The characteristics of the three subsystems—creator, decision-maker, and environment—affect decision-makers' innovation recognition. The creator subsystem includes both the creator and their ideas. Among these, the novelty of the idea is the most important factor affecting decision-makers' innovation recognition. Multiple studies find that the relationship between idea novelty and decision-maker endorsement often follows an inverted U-shaped curve (Boudreau et al., 2016; Criscuolo et al., 2017). This results in the most promising highly novel ideas failing to gain approval and being incorrectly rejected in the initial stage. Whether ordinary consumers or public investors (Haselhuhn et al., 2022; Luan & Kim, 2022) or corporate senior leaders (Criscuolo et al., 2017), all may exhibit cognitive bias against highly novel ideas. This phenomenon of rejecting highly novel ideas is widespread, from business structures (Criscuolo et al., 2017) to scientific research (Packalen & Bhattacharya, 2020; Siler et al., 2015). Additionally, creators' personal characteristics influence decision-makers' evaluations of their innovation projects and creative abilities. For example, entrepreneurs who demonstrate passion when pitching business proposals are more likely to gain recognition from investors, especially non-professional investors (Clarke et al., 2019; Li et al., 2017). For experienced professional investors, entrepreneurs' passion may be interpreted as an impression management strategy, reducing investment willingness; this negative effect is particularly pronounced when entrepreneurs' expertise is not outstanding (Jiang et al., 2023). Previous research also finds that leaders do not always endorse subordinates' creativity, especially when leaders believe subordinates innovate only for self-interest or discover that subordinates have not completed their essential work (Zhou et al., 2020).

The decision-maker subsystem' s greatest impact on innovation recognition lies in the decision-maker role itself. Mueller et al. (2018) use "Decision-makers' Dilemma" to summarize their delicate situation. On one hand, because organizations always call for innovation and innovative solutions may bring excess returns, decision-makers always hope to adopt innovative solutions due to external pressure or internal drive. On the other hand, high returns accompany high risk, and innovation entails high uncertainty. Once innovation is adopted but fails, decision-makers inevitably bear personal responsibility. Therefore, tension forms between high expectations for innovation and the personal risk it entails (Ford & Gioia, 2000; Staw, 1995). To escape this dilemma, decision-makers unconsciously lower their evaluation of novel ideas, deeming them insufficiently innovative; this way, decision-makers can comfortably choose conventional solutions, effectively avoiding the decision dilemma (Mueller et al., 2018). Consequently, when needing to make decisive judgments about highly innovative ideas, decision-makers are more likely to reject rather than adopt them, espe-

cially in highly uncertain environments (Mueller et al., 2018; Mueller et al., 2014).

Decision-makers' roles also affect the accuracy of their innovation recognition. A study of creative industry managers found that despite solid professional knowledge and rich industry experience, their judgment accuracy in predicting whether creative performances would succeed was even lower than that of ordinary audiences (Berg, 2016). More interestingly, subsequent experimental research found that frontline creators' judgment accuracy significantly decreased once promoted to management roles; if managers returned to creator roles, their accuracy improved again. Thus, once assuming decision-maker responsibilities, people' s creativity recognition becomes biased. Mueller et al. (2018) also found that if people only provided expert consultation without decision-making responsibility, they would not be influenced by context to lower evaluations of novel ideas. On the other hand, compared to experts, decision-makers typically have stronger senses of power in organizations, with greater control over work-related matters and more influence (Galinsky et al., 2008). Recent research indicates that when people feel they have high power, they are more willing to accept novel ideas because highly novel ideas can trigger positive associations when one possesses power (Zhou et al., 2022). Additionally, hierarchical level has important effects (Wilden et al., 2023). When evaluating breakthrough innovations, middle managers, focusing on implementation feasibility and other concrete information, are typically skeptical; senior managers, considering only how to expand resources to promote innovation, are more receptive to breakthrough innovations. Thus, the impact of decision-maker roles on innovation recognition is complex, with both positive and negative pathways likely coexisting, warranting further investigation.

The environment subsystem provides resource support and action guidelines for creators' and decision-makers' innovation practices (Csikszentmihalyi, 1999). Existing research finds that organizational and social contexts mainly affect decision-makers' innovation recognition through two pathways. First, by establishing innovation criteria, providing decision frameworks, and guiding innovation direction. Whether a company' s decision framework focuses on pursuing gains or avoiding losses significantly impacts how decision-makers identify and evaluate innovation (Zhou et al., 2017). Compared to gain-oriented goal frames, loss-avoidance goal frames significantly reduce evaluators' accuracy in assessing idea novelty and creativity. When the broader social context shows low acceptance of revolutionary product prototypes, leaders with decision-making responsibilities easily develop doubts about whether the innovation truly possesses potential value and can generate economic returns—doubts sufficient to make decision-makers reject this innovation direction (Mueller et al., 2018). Second, by creating an innovation climate. An organizational climate that encourages innovation can enhance decision-makers' acceptance of highly novel ideas and solutions (Zhou et al., 2017). Conversely, environments conveying high uncertainty inhibit decision-makers' recognition of innovation (Mueller et al., 2014). The fundamental reason may be that in uncertain environments, people implic-

itly associate innovation with risk at the implicit level, and this negative attitude toward innovation causes people to unconsciously reject innovation (Mueller et al., 2012).

2.2.3 Synergistic Effects Among Three Subsystems

Synergistic effects among the decision-maker, creator, and environment subsystems jointly influence innovation recognition. The most typical synergistic effect manifests between decision-makers and creators. After creators propose preliminary innovation plans, they do not passively wait for decision-makers' judgment but actively promote, display, and publicize their ideas through various channels to key figures to gain recognition and support (Perry-Smith & Mannucci, 2017). For example, employees skilled at using various upward influence strategies and presenting their ideas in vivid forms are more likely to win supervisors' recognition of their ideas and ultimately obtain opportunities for further implementation (Lu et al., 2019). Interestingly, active promotion strategies only work when truly high-level innovation is made; for ordinary ideas, such efforts have counterproductive effects.

Research indicates that the relationship between decision-makers and creators influences the former' s innovation recognition in more subtle ways (Qi et al., 2022). The typical corporate innovation process involves creators (employees) generating ideas for decision-makers' reference, with the latter identifying quality ideas from employees' initial idea pool for further support. Decision-makers' innovation recognition focuses on screening ideas (Zhou et al., 2019; Qi et al., 2019) but also attends to creators' abilities and creative performance (Zhou et al., 2020); thus, both creators and ideas are objects of innovation recognition. Qi et al. (2022) found that decision-makers typically give higher evaluations to creators with whom they have close relationships, believing their creative performance is better and innovation potential higher, because people often exhibit in-group preference due to social identity needs (Hogg & Terry, 2000). However, when evaluating ideas, despite identical objective innovation levels, decision-makers perceive in-group members' ideas as less creative because intergroup relationships reduce psychological distance (Trope & Liberman, 2010), leading decision-makers to adopt low-level construal to evaluate proximal ideas and focus on risks and uncertainties accompanying highly novel ideas (Duan et al., 2022; Mueller et al., 2014). Thus, pre-existing intergroup relationships between decision-makers and creators may create an innovation recognition paradox: decision-makers may recognize in-group members' creative abilities more but reject their highly novel ideas. Additionally, the three subsystems of ideas, decision-makers, and environment exhibit overall synergistic effects. When the environment' s dominant decision frame is loss avoidance, decision-makers with clear prevention focus show even lower recognition of high-level innovation (Zhou et al., 2017).

2.3 Rivalry: A Critical Factor in Decision-Makers' Innovation Recognition

As previously stated, corporate innovation is always accompanied by fierce competition. Compared to ordinary competition, rivalry produces stronger effects. Therefore, it is necessary to deeply understand the core characteristics and research status of rivalry to expand research on decision-makers' innovation recognition from this new angle. Next, we summarize the key features of rivalry and review its impact effects and mechanisms.

2.3.1 Core Characteristics of Rivalry

Competition universally exists among individuals, teams, departments, organizations, and even nations. Two perspectives exist for defining competition: structural competition and relational competition (To et al., 2020). Both emphasize that important resources (e.g., R&D funding, promotion opportunities, product market share) are always limited and scarce in any context, and competition is an effective means of resource allocation. However, the two perspectives differ in defining competitive success. Scholars holding the structural view believe competition originates from situational structural characteristics—when multiple actors' goals are negatively correlated and each party' s gains are mutually exclusive, competition inevitably arises (Deutsch, 1949; Murayama & Elliot, 2012). In competitive situations, one party' s gain means loss for other parties. Each actor views all others as opponents, attempting to defeat all others to achieve their own goals.

Scholars holding the relational view define competition at the dyadic level (Converse & Reinhard, 2016; Converse et al., 2021; Kilduff, 2019; Kilduff et al., 2010). Competitive parties typically do not view all opponents as identical or attach equal importance to all opponents. Instead, during competition, people pay special attention to one or a few specific opponents; beyond focusing on their own objective gains from competition, they particularly care about whether they outperform specific opponents and define their competitive success accordingly. Once competitive success is directly linked to outperforming a specific opponent, ordinary competition escalates to rivalry, and the competitor becomes a rival (Kilduff et al., 2010). Table 1 summarizes the main differences between ordinary competition and rivalry.

It should be noted that rivalry is a special form of interpersonal competition that, in addition to possessing all features of the latter, has several unique characteristics. Broadly speaking, rivalry' s most core features include: (1) the subjectivity of rivalry designation—who constitutes one' s rival is subjectively determined by the actor. People view opponents who are similar to themselves, closely matched in strength, and have long competitive histories as rivals (Converse et al., 2021; Kilduff et al., 2010). (2) Clear relationship orientation—success is defined by whether one defeats the rival; comparatively, maximizing objective gains in competition is not the most important (Ku et al., 2005).

(3) Rivalry has obvious historical continuity—actors believe current competition with rivals is not completely disconnected from past competitive history but is a continuation of past competition; current competition outcomes may also become part of personal legacy and extend to future competition with that rival (Converse & Reinhard, 2016). (4) Rivalry amplifies the psychological stakes of competition outcomes, even becoming key indicators of self-worth and social status (Converse & Reinhard, 2016; Kilduff & Galinsky, 2017; Kilduff et al., 2016).

Table 1: Comparison of Differences Between Ordinary Competition and Rivalry

Dimension	Ordinary Competition	Rivalry
Definition	Actors' goal achievement is negatively correlated in the same situation; one party' s goal achievement means other parties cannot achieve their goals to some extent (Deutsch, 1949)	Subjectively perceived competitive relationship with another specific actor (Kilduff et al., 2010)
Theoretical Perspective	Structural view: Competition originates from actors' goals being mutually exclusive or negatively linked (Murayama & Elliot, 2012; Swab & Johnson, 2019; To et al., 2020)	Relational view: Competition originates from the special psychological meaning actors assign to competitive relationships (Converse & Reinhard, 2016; Kilduff et al., 2010; To et al., 2020)

Dimension	Ordinary Competition	Rivalry
Competitor Definition and Clarity	Objectively defined: All actors participating in the same goal are mutual competitors; when multiple opponents exist, actors typically distinguish them based on their ability to compete for the goal (Deutsch, 1949)	Subjectively defined: Actors distinguish certain specific opponents (usually those with historical competition) from other opponents; rivalry has higher stakes. The competitive relationship is generally symmetrical, with mutual recognition as rivals, but may also be asymmetrical and one-directional (Converse & Reinhard, 2016; Kilduff et al., 2010)
Outcome Orientation	Outcome-oriented: Committed to obtaining more scarce resources (Swab & Johnson, 2019)	Relationship-oriented: Outperforming the opponent is more important than maximizing objective gains in competition (Ku et al., 2005)

Dimension	Ordinary Competition	Rivalry
Temporal Extension	Competition typically only has immediacy; once a competitor no longer participates in current competition, the competitive relationship with other competitors and the exiting party ends (Converse & Reinhard, 2016)	Strong temporal extension: Current competition is influenced by past competitive history, and competition outcomes also have important impacts on future competition; competition outcomes may become part of personal legacy and be remembered in history (Converse & Reinhard, 2016)
Main Factors Influencing Competition Intensity	Goal importance, resource scarcity, degree of negative goal interdependence (Swab & Johnson, 2019)	Similarity between dyadic parties, performance proximity, competitive history (Kilduff et al., 2010)

[Compiled based on primary reference sources]

2.3.2 Positive Effects of Rivalry

Rivalry' s positive aspects mainly manifest through enhancing actors' winning motivation, thereby increasing their effort levels and ultimately improving performance. Kilduff et al. (2010) explored the impact of rivalry between university men' s basketball teams on subsequent games using archival data from U.S. college basketball leagues. Results showed that when playing rivals, players had stronger motivation, exerted more effort in defense and shot-blocking, and ultimately helped their teams achieve good results. Subsequently, Kilduff (2014)

used archival data from major long-distance running competitions and found that if long-term competitors also participated, runners had stronger winning motivation and could run faster during races. Similarly, Pike et al. (2018) analyzed archival data from the four major U.S. professional sports (basketball, football, baseball, ice hockey) and found that if a team' s rival achieved good results in a season' s playoffs, the team' s playoff performance in the next season would improve; this stimulating effect was particularly pronounced if the rival won the championship in the previous season. Recent meta-analysis results indicate (Milstein et al., 2022) that rivalry' s impact on performance is stronger than ordinary competition; rivalry' s effect at the individual level is stronger and more stable than at the group level; in physically confrontational sports competitions, rivalry' s effect is more prominent and is mostly facilitative.

2.3.3 Negative Effects of Rivalry

Despite significantly enhancing individuals' winning motivation and behavioral performance, rivalry also has multiple negative effects. First, rivalry makes decision-makers more inclined to take risks in risky decision-making. When playing against rival teams, players are more willing to adopt risky game strategies (To et al., 2018). Additionally, researchers have found that to avoid falling behind rivals, fighter pilots are willing to risk their lives to achieve victory (Ager et al., 2022); race car drivers are more likely to collide with their rivals during races (Piezunka et al., 2018). Second, competitive arousal induced by competitive pressure prompts decision-makers to make overestimation judgments and behaviors in decision-making. For example, auction participants frequently overbid (Ku et al., 2005), possibly because competitive pressure causes high emotional and physiological arousal (Adam et al., 2015; Buckert et al., 2017) and generates strong winning motivation (Malhotra, 2010). Third, when competing with rivals, people adopt aggressive strategies without thorough consideration, with shallow and unsystematic cognitive processing (Converse & Reinhard, 2016). Rivalry also reduces people' s willingness for teamwork and is detrimental to creative performance output (Yip et al., 2018).

Rivalry even leads to unethical and deceptive behaviors. Kilduff et al. (2016), based on archival data from football games and three laboratory experiments, found that rivalry increases actors' psychological risk and concerns about self-worth and status, leading them to adopt performance-oriented approaches and increasing unethical behaviors such as unsportsmanlike violations, use of deception, and willingness to adopt unethical negotiation strategies. Additionally, exposure to opponents increases actors' Machiavellianism (willingness to win by any means), false inflation, and self-interested deception. When facing rivalry, competitive mindset effects override moral identity as a behavioral guide, so even those with high moral identity engage in unethical behavior (Kilduff & Galinsky, 2017). When directly competing with rivals, people even deliberately create obstacles to prevent opponents from smoothly achieving goals (Huang et al., 2019).

2.3.4 Mechanisms of Rivalry

Existing research indicates that rivalry influences individuals' decisions and behaviors through motivational and emotional pathways. From the motivational pathway, rivalry evokes strong winning motivation; driven by this motivation, individuals are willing to exert greater effort to defeat rivals, thereby achieving higher performance (Kilduff, 2014). Rivalry also activates actors' approach motivation and promotion focus (Kilduff et al., 2016), making people more willing to take risks to avoid falling behind rivals (Ager et al., 2022; Piezunka et al., 2018). Rivalry' s emotional pathway mainly manifests in high emotional and physiological arousal when competing with rivals (Adam et al., 2015; Buckert et al., 2017). This competitive arousal is even reflected in physiological indicators such as accelerated heart rate (To et al., 2018). Because competitive arousal levels are high, people often make irrational decisions, such as frequently overbidding in auctions (Ku et al., 2005; Malhotra, 2010).

Rivalry can evoke strong winning motivation and emotional responses because people often link rivalry outcomes to self-worth and self-identity (Converse et al., 2021). When competing with rivals, people easily define themselves using competitive relationship schemas, thus often recalling past competition scenarios with the other party from the current competition, making them unconsciously think about whether they can outperform the opponent, focus on both parties' historical status, and consider the special significance of this competition for the future (Converse & Reinhard, 2016). On the other hand, losing in rivalry makes people feel stronger self-threat, making the desire to win at all costs stronger (Kilduff et al., 2016). Because rivalry is endowed with greater psychological meaning, with outcomes seen as concerning self-worth and social status, people are more likely to engage in unethical behaviors such as fouls, deception, and unethical negotiation strategies during competitions (Kilduff et al., 2016). For example, in professional sports (ice hockey, basketball, football, etc.), when a player faces their former team, especially after unpleasant experiences such as limited playing time, pay cuts, or being sold, they exert more effort and commit more aggressive acts during games (Assanskiy et al., 2022).

2.4 Limitations of Decision-Makers' Innovation Recognition Research and New Directions

As stated above, innovation recognition research focuses on how the three subsystems of creator, decision-maker, and environment, as well as synergistic effects among them, influence decision-makers' innovation recognition. However, most existing studies focus only on single decision-makers, ignoring the important role of competitive factors between decision-makers. In real scenarios, competition is an indispensable key element of corporate innovation. Rivalry like that between Mobike and ofo increases each decision-maker' s motivation to defeat the other, prompting both parties to engage in an innovation arms race. As shown in Figure 2 [Figure 2: see original paper], decision-makers do not lead corporate

innovation confined to their own small environment but identify and screen the most promising innovation projects and talents in the process of competing with opponents. Decision-makers need to constantly monitor rivals' latest innovation movements because opponents are not only competitors but also important information sources. After all, whether opponents' R&D projects succeed or fail, they are key signals for predicting future technology development trends and market competition focal points (Guo et al., 2020; Krieger, 2021; Markou et al., 2023). This project argues that if research continues to ignore competitive factors between decision-makers, innovation recognition research will suffer from at least three shortcomings.

First, ignoring competitive factors will cause research findings to seriously diverge from corporate innovation practice. Currently, the core issue in innovation recognition research is exploring why decision-makers often reject highly novel ideas, manifested as underestimation bias (Mueller & Yin, 2021; Zhou et al., 2019; Qi et al., 2021). However, when competitors launch fierce challenges, decision-makers' primary goal in innovation is to use innovation to enhance their department' s ability to respond to rivals' challenges and establish an invincible position in competition. If highly novel ideas only have potential value in the long term, the emergence of underestimation bias precisely reflects what decision-makers currently prioritize. Only by understanding decision-makers' motivations, strategies, and internal processes for identifying and screening innovation strategies from a competitive perspective can we truly reveal the fundamental sources of various biases in decision-makers' innovation recognition.

Second, ignoring competitive factors will make it difficult to discover more critical decision-maker cognitive biases. To win in rivalry, decision-makers specifically formulate response strategies targeting opponents' goals, which may be the fundamental source of various cognitive biases. If decision-makers only value innovation solutions that help defeat rivals, they often develop tunnel vision, leading to biases such as myopia (rejecting innovations with huge potential), strabismus (overlooking high-potential innovations in other domains), and overestimation (overvaluing currently feasible innovations). If research only focuses on the impact of various systems within the small environment where single decision-makers are situated and ignores the key role of competitive factors between decision-makers, it will be difficult to diagnose these biases.

Third, ignoring competitive factors will prevent true revelation of the internal mechanisms causing cognitive biases. Existing research suggests that decision-makers exhibit cognitive biases because they hold implicit biases against highly novel ideas (Mueller et al., 2012) or due to needs to avoid risk and uncertainty (Mueller et al., 2018; Mueller et al., 2014). However, innovation recognition and evaluation are essentially cognitive processing activities; analyzing cognitive biases only at the attitudinal level is neither comprehensive nor sufficiently explanatory. Approaching from the rivalry perspective and deeply analyzing the cognitive processing processes of decision-makers' innovation recognition to reveal how cognitive depth and breadth pathways function is key to understanding

decision-makers' cognitive biases.

Thus, this project proposes that exploring how rivalry between decision-makers affects both parties' innovation recognition efficiency represents the most theoretically meaningful and practically valuable new direction in this field. Research should not be limited to exploring decision-makers' innovation decision-making processes and outcomes within their own innovation systems but should expand to the real context of corporate innovation, considering how decision-maker-decisionaker relationships affect both parties' innovation recognition efficiency and its underlying mechanisms.

[Figure 2: see original paper] Conceptual Model of How Rivalry Affects Decision-Makers' Innovation Recognition

3. Research Framework

Rivalry theory (Converse & Reinhard, 2016; Kilduff et al., 2010) provides a framework for exploring how competition between decision-makers and their main opponents affects their accuracy in identifying novel ideas. Approaching from the rivalry perspective raises many worthwhile questions. The most critical question is whether rivalry enhances or reduces decision-makers' innovation recognition accuracy. Existing theories cannot provide clear answers to this question.

Innovative products are novel stimuli, and innovation recognition is essentially a cognitive processing activity. Like other cognitive processing activities, decision-makers need to selectively search for, extract, encode, integrate, and utilize relevant information and establish connections with features of novel target stimuli to understand and judge their value (Zhou et al., 2017). Just as the depth and breadth of creators' cognitive processing affect the quality of their creative output (Nijstad et al., 2010), the depth and breadth of decision-makers' cognitive processing are also decisive factors in their innovation recognition quality (Levin et al., 2000). Cognitive processing depth depends on how individuals integrate and utilize information (Chaiken & Trope, 1999; Evans, 2008). Compared to individuals who rely on heuristic processing, those who adopt systematic processing for judgment and decision-making expend more cognitive effort and have deeper cognitive processing. Cognitive processing breadth refers to the range of information sources individuals use during judgment and decision-making; the richer the information sources decision-makers obtain and the larger the scope, the greater their cognitive breadth (Levin et al., 2000).

Combining rivalry theory and the cognitive processing perspective on innovation recognition, this project proposes that rivalry' s impact on decision-makers' innovation recognition has multiple effects and involves two independent cognitive processing pathways. The first is cognitive processing depth, referring to whether people are willing to adopt systematic processing to understand things (De Dreu et al., 2008). The second is cognitive processing breadth; when vision is narrow, people often focus on one point without attending to others (Posavac

et al., 2010). To comprehensively reveal rivalry' s impact on decision-makers' innovation recognition accuracy, we must examine how rivalry affects both cognitive processing depth and breadth pathways. On one hand, when competing with rivals, people' s self-regulation ability deteriorates, and they often make decisions hastily without careful consideration (Converse & Reinhard, 2016), which is unfavorable for accurately identifying innovation. On the other hand, rivalry greatly enhances people' s cognitive motivation, and decision-makers are willing to double their efforts to defeat opponents, striving to comprehensively and accurately understand current tasks through deep cognitive processing, thus potentially improving cognitive processing quality (De Dreu et al., 2008; Wu & Bai, 2012). Additionally, rivalry makes decision-makers closely monitor opponents' movements. Overly focused attention resources easily create tunnel vision, ignoring stimuli outside the field of view; but focused thinking may also help people handle current tasks well.

To test these hypotheses, this project will explore three core questions. First, examine rivalry' s effect on decision-makers' innovation recognition—that is, how the accuracy of decision-makers' identification and screening of highly novel innovations is affected by the competitive form between decision-makers. Compared to ordinary competition, is recognition accuracy higher or lower when competing with rivals? Second, reveal the internal mechanisms through which rivalry affects decision-makers' innovation recognition—that is, how rivalry influences decision-makers' cognitive depth and breadth to ultimately affect innovation recognition accuracy. Generally speaking, compared to ordinary competition, when competing with rivals, are decision-makers more likely to engage in systematic processing (cognitive depth pathway) and more likely to develop narrow vision (cognitive breadth pathway)? Third, identify boundary conditions of rivalry' s impact on decision-makers' innovation recognition. While typical strategies conceive moderating variables from individual and situational characteristics, this study plans to explore important constraints on rivalry' s impact on innovation recognition based on unique characteristics of decision-maker-decision-maker dyads. Generally, this study focuses on how decision-makers adjust cognitive processing strategies as they continuously learn about rivals' innovation content and direction, ultimately evaluating the same innovation differently.

This study plans to conduct four studies. The first three are experimental studies aimed at comprehensively revealing the effects and cognitive mechanisms of rivalry on decision-makers' innovation recognition, focusing on identifying both positive and negative effects and establishing causal relationships. Before conducting experimental studies, pre-studies are needed to prepare required materials. Study 4 uses archival analysis to cross-validate experimental results in real-world settings and enhance ecological validity. Figure 3 [Figure 3: see original paper] presents the overall research framework. Below are detailed introductions to each study' s main content, proposed research methods, and expected results. It should be noted that most organizations have hierarchical structures, with significant differences in authority and responsibility across high, middle,

and low-level leaders. From the systems perspective on creativity (Csikszentmihalyi, 1999), decision-makers do not refer to leaders at a specific level but any individual with final decision-making authority on whether to adopt an idea, project, or solution. Considering that decision-makers at any level may view opponents who are similar, closely matched, and have long competitive histories as rivals (Converse et al., 2021; Kilduff et al., 2010), and that how rivalry affects decision-makers' innovation recognition is still in its early research stages, this project focuses on exploring the three core questions above. Whether rivalry' s impact on innovation recognition differs across decision-maker hierarchical levels is left for future research. Given this, this study draws on previous strategies (Mueller et al., 2018; Bai et al., 2019), where laboratory study participants have final decision-making authority when completing innovation recognition tasks, and field studies only recruit individuals with final decision-making authority on innovation decisions.

[Figure 3: see original paper] Dual-Pathway Model of How Rivalry Affects Decision-Makers' Innovation Recognition

3.1 Cognitive Depth Pathway of Rivalry' s Impact on Innovation Recognition (Study 1)

Most existing rivalry research has been conducted in sports competition contexts, with effects mainly manifested in athletes' physical investment. Unlike this, innovation recognition is a cognitive processing activity, and many studies show that competition also affects individuals' cognitive processing. This is because external competition enhances people' s cognitive motivation—the willingness to expend effort to comprehensively and accurately understand things (De Dreu et al., 2008; Wu & Bai, 2012). Therefore, when competition outcomes with rivals depend on achieving better innovation performance, decision-makers need to rely on systematic processing to comprehensively and accurately assess the potential and feasibility of various innovation solutions. Thus, this project proposes that rivalry enhances decision-makers' systematic processing, ultimately helping improve innovation recognition accuracy.

To test this hypothesis, Study 1 will conduct three experiments exploring how rivalry affects innovation recognition accuracy through the cognitive depth pathway. Study 1a will manipulate competitive form, measuring systematic processing and innovation recognition accuracy. Study 1b will adopt a more rigorous experimental design, testing the mediating effect of systematic processing by manipulating the mediator to better resolve causal relationships between variables (Pirlott & MacKinnon, 2016; Spencer et al., 2005). Study 1c will conduct a field experiment to cross-validate results from Studies 1a and 1b. Before formal experiments, pre-studies will obtain required experimental materials.

3.1.1 Pre-Study: Innovation Product Database and Evaluation Criteria Before conducting innovation recognition research, two key materials must be prepared: establishing an idea pool for identification and evaluation,

and obtaining objective evaluation scores for each innovation in the pool to measure participants' innovation recognition accuracy. Following previous common strategies (Mount et al., 2021; Mueller et al., 2018; Zhou et al., 2017; Zhou et al., 2022), pre-studies will establish the required idea pool and evaluation criteria.

(1) **Constructing the innovation recognition idea pool.** Since innovation recognition essentially involves judging ideas/innovation product prototypes that are still in embryonic form with not fully demonstrated potential, ideas/products in the pool must possess novelty and breakthrough characteristics while also having rich, comprehensible information to stimulate participants' cognitive judgments. Previous research typically uses cutting-edge technological inventions that are at the forefront and not yet widely popularized as materials, such as quantum key distribution technology (Mount et al., 2021) and biochips (Qi et al., 2022). This project plans to select appropriate products and ideas from MIT Technology Review' s annual "10 Breakthrough Technologies." Since 2001, the magazine has selected annual "10 Breakthrough Technologies," inviting domain experts to write technology introduction information for each technology. This complete innovation product database will meet this project' s material requirements.

(2) **Establishing objective innovation evaluation criteria.** Following previous experience (Berg, 2016; Zhou et al., 2017), we will invite a sufficient number of experts to evaluate the novelty and usefulness of selected ideas to establish definitive objective criteria for assessing participants' evaluation accuracy.

3.1.2 Rivalry's Impact on Innovation Recognition Accuracy (Study 1a)
Purpose: To explore the main effect of rivalry on decision-makers' innovation recognition and reveal the mediating role of cognitive processing depth.

Experimental Design: Drawing on previous research scenario settings (Mount et al., 2021), participants will act as investors in a professional investment firm, examining four innovation projects and deciding whether to invest in each project; simultaneously, other investment firms are also examining these projects. Participants' goal is to assess these innovation projects as accurately as possible. Following Kilduff et al.' s (2016) manipulation methods, different types of competitors will be set. In the rivalry group, the opponent is a rival similar in all aspects, with a long competitive history and evenly matched institutions; in the ordinary competition group, the opponent lacks these characteristics and is merely an ordinary peer in the industry; in the control group, participants evaluate innovation projects alone without a competitor.

Variable Measurement: All innovation project information will be presented via computer, with the computer backend automatically recording all parameters of participants' reading materials (e.g., reading duration, types of information attended to) as measures of systematic processing degree and cognitive

depth. Participants will evaluate the innovativeness of all projects, and these evaluations will be compared with objective innovation scores obtained from the pre-study to calculate recognition accuracy. Participants will be asked about expected investment outcomes for each innovation project.

Expected Results: Competitor type will have a main effect—compared to ordinary opponents, innovation evaluation accuracy will be higher and systematic processing deeper when competing with rivals; systematic processing will mediate the effect of competitor type on evaluation accuracy. Simultaneously, both experimental groups' innovation evaluation accuracy will be higher than the control group.

3.1.3 Causal Verification of Cognitive Processing Depth' s Mediating Effect (Study 1b) Purpose: In Study 1a, both the mediator (systematic processing) and dependent variable (innovation evaluation accuracy) were only measured, making it difficult to fully reflect their causal relationship. Study 1b will use experimental design to further test systematic processing' s mediating role between competitor type and innovation recognition accuracy.

Experimental Design: The research scenario is consistent with Study 1a, where participants act as professional investors examining four innovation projects and competing with other investors. Following classic methodological literature on revealing mediating effects through experimental methods (Pirlott & MacKinnon, 2016; Spencer et al., 2005), a 2$×$3 between-subjects design will be conducted, manipulating both competitor type and cognitive processing method. Competitor type manipulation follows Study 1a but includes only two levels—rival or ordinary opponent—excluding the no-competitor condition. Cognitive processing method during innovation project evaluation will be manipulated into three levels. Research on cognitive motivation shows that high time pressure reduces people' s cognitive processing depth (De Dreu et al., 2008; Wu & Bai, 2012). Therefore, time pressure will be manipulated through instructions to affect participants' cognitive processing methods (Bechtoldt et al., 2010). Under all three conditions, participants will have identical time for innovation evaluation, with only instructions manipulating time pressure. The high time pressure condition emphasizes that innovation depends on speed to win, reminding participants to quickly complete idea evaluation within limited time; the low time pressure condition emphasizes that innovation wins through quality, reminding participants to fully utilize time to evaluate ideas; the no time pressure manipulation group is the control group with no such emphasis, only told to complete evaluation within the allotted time.

Variable Measurement: Consistent with Study 1a, innovation project evaluation accuracy will be measured. Additionally, the computer backend will automatically record all parameters of participants' reading materials as measurement indicators of systematic processing, though at this point, systematic processing measurement will only be used to test the effectiveness of time pressure manipulation.

Expected Results: High time pressure causes people to engage in rapid rather than systematic processing, which will suppress the positive effects brought by rivalry. Therefore, if the mediating effect of systematic processing holds, the following will occur: under high pressure, the evaluation accuracy difference between rivalry and ordinary competition may not be significant; low time pressure allows systematic processing, amplifying rivalry' s positive effects, making the evaluation accuracy difference between the two competition types significant; the control group without time pressure manipulation will replicate Study 1a results, where innovation evaluation accuracy under rivalry conditions is higher than under ordinary opponent conditions.

3.1.4 Field Experiment on Rivalry' s Impact on Innovation Recognition Accuracy (Study 1c) A field experiment will be conducted to cross-validate the results of the two laboratory experiments and enhance ecological validity. Management personnel serving as decision-makers in various organizations will be invited to participate. Consistent with existing research (Mount et al., 2021; Mueller et al., 2018), the innovation product prototypes used in the above studies will still be employed as research materials to reduce errors caused by participants' different job natures.

Experimental Design: The experimental scenario is consistent with Study 1a. The competitor manipulation method draws on Kilduff and Galinsky (2017), where participants recall a person with whom they had rivalry (rivalry group); or recall a person with whom they had competition but not personal animosity (ordinary competition group); or simply recall a person unrelated to competition and innovation (control group).

Variable Measurement: Consistent with Study 1a, innovation project evaluation scores and total number of cards turned over (cognitive depth measurement indicator) will be measured.

Expected Results: Replicate Study 1a results—competitor type has a main effect, with higher innovation evaluation accuracy and deeper cognitive processing when competing with rivals compared to ordinary opponents; processing depth mediates the effect of competitor type on evaluation accuracy. Simultaneously, both experimental groups' innovation evaluation accuracy will be higher than the control group.

3.2 Cognitive Breadth Pathway of Rivalry' s Impact on Innovation Recognition (Study 2)

In real environments, innovation always occurs within specific communities. For example, an enterprise is nested within an industry and region, needing to interact with upstream and downstream suppliers and customers and timely launch products or services to the market; any scientific research has relatively clear professional directions and requires communication with peers; coupled with personnel mobility, most innovation-performing institutions find it difficult to

completely keep their R&D information confidential. This also means that information has some mobility within this community. Competitors' R&D movements are very important information, as they indicate technology development trends and future market competition focal points (Markou et al., 2023). When rivalry reaches a certain stage and opponents learn about each other' s innovation projects, what impacts this will have on their own innovation recognition and decision-making is a valuable research question.

Innovation recognition is a challenging task, and coupled with the high uncertainty of novel ideas themselves (Mueller et al., 2014), decision-makers need to invest substantial cognitive resources to process multiple types of information to identify truly novel ideas. Therefore, when competing with rivals, decision-makers focusing on a few projects may also be an efficient strategy. However, if excessive focus on rivals' movements leads to overly narrow cognitive breadth, limited by tunnel vision and ignoring other possible innovation solutions, negative consequences may also result (Posavac et al., 2010).

Thus, although narrowed cognitive processing scope may cause decision-makers to miss other novel innovations outside the focus, their evaluation of innovation projects within the cognitive focus may become more accurate. Therefore, tunnel vision caused by rivalry may have a double-edged sword effect. Furthermore, because decision-makers will pay more attention to targets that rivals focus on, if the latter' s focused innovation projects are themselves high-quality, this may enhance the focal decision-maker' s innovation recognition efficiency. Study 2 will approach from the perspective of tunnel vision and conduct two studies exploring the multiple effects that may occur when cognitive processing breadth decreases and scope narrows.

3.2.1 The Double-Edged Sword Effect of Narrowed Cognitive Breadth (Study 2a) **Purpose:** Building on the assumption that in rivalry situations, learning about opponents'focus targets often leads to narrowed cognitive processing scope to opponents' focus targets, creating tunnel vision, Study 2a explores whether tunnel vision leads decision-makers to evaluate focus-within innovation projects more accurately while showing greater bias toward other projects, thereby demonstrating a double-edged sword effect.

Experimental Design: To fully reveal the double-edged sword effect of tunnel vision and expand the number of innovation projects, participants will act as investment firm investors evaluating four innovation projects. A 2$\times$2 mixed design will be used, with competitor type (rival or ordinary opponent) as a between-subjects variable, manipulated consistently with Study 1. Opponent focus target (key focus or non-key focus) will be a within-subjects variable, manipulated by randomly selecting two projects and informing experimental participants that these are opponents' key focus target projects, with the remaining two as non-key focus projects.

Variable Measurement: Following previous research, cognitive processing

depth and breadth will be measured using the computer-based card-turning task with multi-option multi-attribute information search decision paradigms (Posavac et al., 2010; Rassin et al., 2008). Specifically, using the idea pool compiled in the pre-study, information for each innovation technology will be organized into eight cards. During innovation project evaluation, participants can click any card to view specific information, with no restrictions on card-clicking order or frequency, completing evaluation and selection within the allotted time. The computer backend will record detailed information on participants' card clicking (which cards were viewed, viewing order, reading time, etc.). The proportion of participants' viewing of cards related to opponents' key focus innovation projects relative to total card viewing will be calculated as the measurement indicator of cognitive breadth (tunnel vision). Higher proportions indicate narrower cognitive processing scope and higher degrees of tunnel vision. Participants will evaluate the innovativeness of all projects to measure innovation evaluation accuracy.

Expected Results: (1) Rivalry is more likely to cause narrowed cognitive breadth and tunnel vision: when competing with rivals, participants' viewing proportion of opponents' key focus projects will be higher. (2) Due to tunnel vision, participants' evaluation of focus-within innovation projects will be more accurate, while bias toward non-focus projects will be greater, demonstrating a double-edged sword effect of rivalry in innovation recognition.

3.2.2 Boundary Conditions of the Double-Edged Sword Effect of Narrowed Cognitive Breadth (Study 2b) Study 2a proposed that decision-makers pay more attention to rivals' focus targets and, benefiting from cognitive focus, evaluate their innovativeness more accurately. Based on this, this project further speculates that if rivals' focused innovation projects are high-quality projects, decision-makers' own innovation recognition efficiency will be correspondingly enhanced; however, if rivals' focused projects are of average quality, decision-makers' vision focusing on them while ignoring higher-quality projects outside their field of view will reduce innovation recognition efficiency. In other words, the quality of rivals' focused innovation projects is a moderating variable for whether rivalry can enhance decision-makers' innovation recognition efficiency.

Experimental Design: Consistent with Study 2a, participants will act as investment firm investors evaluating four innovation projects. The difference is that two will be high-quality projects and two will be average-quality projects. A 2$\times$2 between-subjects design will be used, with competitor type manipulation consistent with Study 1, divided into rivalry or ordinary competitor conditions. Either one high-quality project or one average-quality project will be randomly selected and participants informed that this is the project group currently focused on by opponents, manipulating the quality of rivals' focused innovation projects.

Variable Measurement: Similarly, the proportion of target project card view-

ing (cognitive breadth/tunnel vision measurement indicator) and evaluation of all innovation projects will be measured. Additionally, participants will be asked to select the project they believe most worthy of investment as a measurement indicator of innovation recognition efficiency. If the selected project is one of the two high-quality projects, recognition efficiency is high; if one of the two average-quality projects is selected, recognition efficiency is low.

Expected Results: (1) Rivalry is more likely to cause tunnel vision—when competing with rivals, the proportion of target project card viewing will be higher. (2) When competing with rivals, regardless of the quality level of projects within the field of view, tunnel vision will make participants more likely to select a project within the field of view for investment. Consequently, recognition efficiency depends on the quality level of rivals' focused projects, amplifying rivalry' s double-edged sword effect. (3) When the competitor is an ordinary competitor, the likelihood of tunnel vision decreases, the probability of selecting a project within the field of view for investment also decreases, and participants are more likely to select a high-quality project for investment.

3.3 Boundary Conditions of Rivalry' s Cognitive Mechanisms in Innovation Recognition (Study 3)

Study 1 explored how the presence of rivals affects participants' innovation recognition and attempted to examine the mediating effect of cognitive depth. Study 2 attempted to demonstrate that rivalry narrows decision-makers' cognitive breadth, creating tunnel vision and thereby producing a double-edged sword effect. Building on this, Study 3 will conduct two laboratory experiments and one field experiment to explore how decision-makers' innovation recognition cognitive processing methods (i.e., cognitive depth and breadth) change after learning about opponents' innovation-related information. Additionally, beyond decision-makers' difficulty in accurately evaluating innovation project levels (Berg, 2016; Mueller et al., 2018) and even incorrectly rejecting highly novel ideas (Boudreau et al., 2016; Criscuolo et al., 2017; Packalen & Bhattacharya, 2020; Siler et al., 2015), whether decision-makers are willing to endorse and adopt high-quality ideas after accurately identifying them is also important. Studies 1 and 2 only explored decision-makers' innovation evaluation accuracy, while Study 3 will further examine decision-makers' adoption intentions and behaviors toward high-quality projects.

3.3.1 Impact of Knowing Competitors' Innovation Movements on Decision-Makers' Cognitive Processing Depth and Breadth (Study 3a) Purpose: Building on Studies 1 and 2, further reveal how rivalry simultaneously affects decision-makers' innovation recognition through both cognitive processing depth and breadth pathways. This project believes that knowing which innovation projects rivals closely focus on may affect participants' cognitive breadth pathway; but as long as rivals are present, participants' cognitive processing depth during innovation recognition will also

be significantly enhanced.

Experimental Design: Consistent with Study 2a, participants will act as professional investors examining four innovation projects and competing with other investors. Similarly, a 2$×$2 mixed design will be used, with competitor type (rival or ordinary opponent) as a between-subjects variable, manipulated consistently with Study 1. Opponent focus target (key focus or non-key focus) will be a within-subjects variable, with one project randomly selected and participants informed that this is the opponent' s key focus target project.

Variable Measurement: Integrating Studies 1 and 2, total number of cards turned over (cognitive depth/systematic processing measurement indicator), proportion of target project card viewing (cognitive breadth/tunnel vision measurement indicator), and innovation project evaluation and investment willingness (outcome variables) will be measured.

Expected Results: (1) The systematic processing indicator (total cards turned over) will be affected by competitor type, with more cards turned over under rivalry. (2) Competitor type will also significantly affect cognitive breadth (proportion of target card viewing): after learning about rivals' focus targets, participants' card viewing proportion for that innovation project will be highest, possibly indicating obvious tunnel vision. (3) Participants will evaluate the innovativeness of rivals' focused innovation projects higher and show stronger investment willingness.

3.3.2 Effect of Competitors Abandoning Original Innovation Projects (Study 3b) Innovation is always full of risk and uncertainty, and any project may encounter failure (Stevens & Burley, 1997). If competitors' R&D projects suffer setbacks, or opponents voluntarily withdraw from or abandon previous innovation projects, this is extremely important information for the other party, as it either indicates that the technology path is unfeasible or means a rare market gap has emerged (Krieger, 2021). However, no research has examined how decision-makers will evaluate their own innovation choices after learning that competitors have withdrawn from or abandoned innovations. Study 3b will explore this phenomenon.

Purpose: Building on Study 3a, further explore how decision-makers' innovation recognition changes when they learn that competitors have abandoned their previously closely followed specific innovation projects.

Experimental Design: The research scenario is consistent with Study 3a. A 2$×$2 between-subjects design will be used, manipulating competitor type (rival or ordinary opponent) and opponent' s focus on specific targets (focus or abandon). One project will be randomly selected, and participants informed that this is a project currently focused on by opponents (focus group) or a project previously focused on but no longer attended to by opponents (abandon group). Competitor type manipulation follows Study 3a.

Variable Measurement: Consistent with Study 3a, total cards turned over (cognitive depth/systematic processing), proportion of target card viewing (cognitive breadth/tunnel vision), and innovation project evaluation and investment willingness (outcome variables) will be measured.

Expected Results: (1) The interaction of the two factors will significantly affect target card viewing proportion—after learning that rivals have abandoned focus on specific targets, total cards turned over will increase. (2) The interaction will significantly affect target card viewing proportion—after learning that rivals have abandoned focus on specific targets, card viewing for that project will be highest, higher than when learning that rivals continuously focus on a specific target. (3) Participants will give high innovativeness evaluations and show strong investment willingness toward innovation projects that rivals focus on or abandon.

3.3.3 Field Experiment on How Knowing Competitors' Innovation Information Affects Decision-Makers' Cognitive Processing Depth and Breadth (Study 3c)

Purpose: In actual decision-making contexts, cross-validate the results of Study 3a (how knowing competitors' innovation information affects decision-makers' cognitive processing).

Experimental Design: Consistent with Study 3a, a 2 (competitor type, between-subjects) × 2 (opponent focus target, within-subjects) mixed design will be used. The field study strategy will be similar to Study 1c, inviting management personnel serving as decision-makers in various organizations to participate and using the same innovation product prototypes as previous studies to exclude errors caused by participants' different job natures.

Variable Measurement: Same as Study 3a.

Expected Results: Replicate Study 3a results: (1) Cognitive depth (total cards turned over) will be affected by competitor type, with more cards turned over under rivalry. (2) Cognitive breadth (proportion of target card viewing) will be affected by competitor type—after learning about rivals' focus targets, card viewing proportion for that innovation project will be highest, possibly indicating obvious tunnel vision. (3) Participants will evaluate the innovativeness of rivals' focused innovation projects higher and show stronger investment willingness.

3.4 Archival Study of Rivalry's Impact on Decision-Makers'Innovation Recognition (Study 4)

The greatest advantage of secondary archival analysis is data authenticity and richness, which perfectly complements methods like experimental research and questionnaires where researchers actively elicit required data according to research purposes. Both innovation recognition and rivalry happen to have substantial archival data available. For example, in innovation recognition research,

some researchers have obtained internal corporate archival data on decision-makers' screening of innovation projects (Criscuolo et al., 2017), while others have used published paper information to assess research foundations' project funding characteristics (Packalen & Bhattacharya, 2020). Rivalry research uses archival data even more commonly, with the most frequently used archival data being game records from professional basketball, football, baseball, and other sports leagues (Pike et al., 2018). This project also plans to obtain publicly searchable data to analyze how rivalry between decision-makers affects their innovation recognition.

This study plans to use data from domestic public mutual funds to analyze whether competitive relationships between fund managers affect focal fund managers' identification and screening of corporate innovation. Public mutual fund secondary data have several characteristics that align with this project's research topic: (1) Data are rich and accessible—China requires public mutual funds to regularly disclose all data, and many professional institutions (e.g., Wind Financial Database, Tian Tian Fund Network) also have rich data available for extraction. (2) Fund managers are fund decision-makers, and their identification and evaluation of enterprises' new products and innovation potential will largely determine their investment decisions. (3) All core constructs involved in this project can be calculated based on raw data. For example, based on rivalry' s definition (i.e., pairwise similarity, past performance, length of time competing in relevant domains) (Kilduff et al., 2010), social network analysis techniques (Piezunka et al., 2018) can be used to measure competitive relationships between fund managers. The overlap degree of two fund managers' current selections can serve as an indicator measuring the cognitive breadth pathway in their innovation recognition process, etc.

4.1 Dual-Pathway Model of Rivalry' s Impact on Decision-Makers' Innovation Recognition

Based on rivalry theory (Converse & Reinhard, 2016; Kilduff et al., 2010) and combining the cognitive processing perspective on innovation recognition (Levin et al., 2000; Nijstad et al., 2010; Zhou et al., 2017), this project constructs a dual-pathway model of cognitive depth and breadth of how rivalry affects decision-makers' innovation recognition, attempting to reveal the cognitive mechanisms through which competitive relationship forms between decision-makers influence their innovation recognition. The model' s main propositions include: (1) Rivalry may both enhance decision-makers' innovation recognition accuracy and cause serious bias in innovation recognition, showing a typical double-edged sword effect. (2) The fundamental reason for rivalry' s double-edged sword effect may be that rivalry simultaneously affects decision-makers' cognitive processing depth and breadth pathways—both stimulating decision-makers to engage in systematic processing (cognitive depth pathway) and causing decision-makers' cognitive processing to become more focused (cognitive breadth pathway). (3) As decision-makers continuously deepen their understanding of rivals' innova-

tion projects, they will rely on different cognitive processing strategies. In early stages with insufficient understanding, decision-makers are more likely to activate the cognitive depth pathway; as understanding of rivals' innovation direction develops, the cognitive breadth pathway plays the main role, narrowing cognitive breadth and focusing more on opponents' innovation choices, but also potentially creating tunnel vision. (4) The impact of narrow vision on decision-makers' innovation recognition accuracy partly depends on the quality of competitors' innovation recognition. If opponents focus on high-quality innovation projects, rivalry may enhance decision-makers' innovation recognition accuracy; when opponents' recognition accuracy is poor, decision-makers may also exhibit recognition bias.

This study is the first to introduce competitive factors into innovation recognition research, particularly focusing on rivalry as a special competitive form, constructing a dual-pathway model of cognitive depth and breadth of how rivalry affects decision-makers' innovation recognition, and is expected to answer three key scientific questions. First, will cognitive processing-centered innovation recognition activities be affected by rivalry between decision-makers? Rivalry is common in professional sports contexts and also frequent in daily work and life interpersonal interactions; competition between enterprises of similar strength in the same industry is often depicted as rivalry. Whether rivalry forms between department/institution decision-makers and whether this competitive form affects their innovation recognition decisions is the most important scientific question this project needs to address. Second, what impacts may rivalry between decision-makers have on both parties' innovation recognition? Previous research found that rivalry produces strong effects in sports competitions and other contexts, stimulating people' s winning motivation, making them willing to invest greater effort and achieve better competition results. However, rivalry also brings negative effects, such as more frequent risk-taking, conflict, and aggressive behavior. In decision-makers' innovation decision-making processes, are rivalry' s effects positive or negative? When can it bring positive effects, and when will it lead to negative effects? Third, is the cognitive processing process a mediating mechanism through which rivalry affects innovation recognition? Existing research mainly focuses on how rivalry influences individual behavior and decision-making through motivational and emotional arousal pathways. Decision-makers'innovation recognition belongs to cognitive processing; whether rivalry can influence decision-makers through this pathway is also an important research question this project attempts to deeply explore.

4.2 Innovations and Contributions of the Dual-Pathway Model

This project' s characteristics and innovations are reflected in the following aspects. First, this project is the first to introduce interpersonal competitive factors into decision-makers'innovation recognition research, expanding the theoretical depth and practical relevance of innovation recognition research. The most

important finding in innovation recognition research is that decision-makers often cannot accurately identify highly novel innovations, thus exhibiting underestimation bias. However, existing research generally ignores competition as a key feature of innovation contexts, not only causing research to disconnect from core elements of management practice but also potentially preventing research findings from fully reflecting objective reality. In fierce competition, decision-makers often underestimate highly novel innovations with long-term potential because rapidly enhancing their department' s or organization' s ability to respond to rivals' challenges is decision-makers' current priority. In addition, in entanglement with rivals, decision-makers may also exhibit overestimation bias —overestimating the effectiveness of their own innovation decisions—or omission bias—missing more effective innovation solutions—which may directly lead to failure in corporate innovation strategy. This study introduces the rivalry theory perspective, which not only helps reveal various cognitive biases in real contexts but also enhances research practical relevance.

Second, this project is the first to explore innovation recognition issues at the decision-maker-decision-maker dyad level, enriching research levels and approaches. Existing research emphasizes that decision-makers need to engage in perspective-taking, understanding the innovation process and outcomes from employees' perspectives to improve innovation recognition accuracy. This study, from the dyad perspective, points out the necessity of paying attention to peers' and even rivals' thinking frameworks. It should be noted that this study focuses on the competitive attributes of dyads, points out that such attributes may have double-edged sword effects, and attempts to reveal the mediating mechanisms and boundary conditions of these effects, expanding the levels and theoretical perspectives of innovation recognition research.

Third, this project demonstrates the importance of cognitive processing processes and is the first to explore cognitive depth and breadth within the same framework, which helps reveal the deep-rooted causes of innovation recognition bias. Previous research suggests that decision-makers exhibit cognitive biases because they hold implicit biases against highly novel ideas or due to needs to avoid risk and uncertainty. This project, from the cognitive processing perspective, points out the cognitive roots of innovation recognition bias, providing more operational practical guidance for overcoming bias.

Finally, this project also makes important contributions to rivalry theory. Rivalry research has mostly been limited to sports competitions, auction bidding, fundraising, and other limited contexts, believing that it mainly affects individual behavior through motivational and emotional pathways. This project expands this theory to the innovation field and emphasizes rivalry' s cognitive pathway in affecting judgment and decision-making, expanding the universality of rivalry competition theory.

This project also has important implications for organizational leaders to improve innovation decision quality and optimize innovation management effectiveness. Management practice cases and empirical research results both show

that decision-makers often exhibit innovation recognition bias (Mueller & Yin, 2021; Qi et al., 2021). However, bias often stems from some unconscious implicit processes; only by fully understanding the underlying deep reasons can decision-makers possibly become self-aware, reflect, and correct bias. This project reveals the cognitive processing processes of corporate leaders' innovation decisions from a competitive perspective, demonstrating rivalry' s double-edged sword effects on innovation decision-making and the mechanisms and boundary conditions for these effects. Research results can help decision-makers better understand the important sources, manifestations, and internal mechanisms of innovation recognition bias, enabling them to consciously avoid and guard against cognitive bias during innovation decision-making processes.

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Note: Figure translations are in progress. See original paper for figures.