Research on the Mechanisms by Which Human-AI Collaboration Influences Hybrid Problem Solving in Social Entrepreneurship: Based on the Attention-Based View

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Abstract

Social entrepreneurship faces hybrid challenges arising from conflicts between social and economic logics, posing challenges to entrepreneurs'allocation of attention and creating an urgent need to explore effective pathways for solving hybrid problems. Based on the attention-based view, this study analyzes the mechanism through which human-AI collaboration influences the solving of hybrid problems in social entrepreneurship and constructs a theoretical framework of "human-AI collaboration–attention investment–hybrid problem solving in social entrepreneurship." Specifically, the study examines three modes of human-AI collaboration and their pathways of influence: AI-led collaboration optimizes the efficiency of data-driven resource utilization by enhancing entrepreneurs' sustained attention investment; human-led collaboration achieves a dynamic balance among the demands of diverse stakeholders by strengthening alternating attention investment; and interactive human-AI collaboration promotes the creative integration of social and economic value through dual attention synergy. In terms of theoretical contributions, this study deepens research on the micro-level cognitive mechanisms underlying hybrid problem solving in social entrepreneurship and extends the applicable contexts and boundaries of the attention-based view and human-AI collaboration theory. In terms of practical contributions, it provides social entrepreneurs with a cognitively empowering pathway for human-AI collaboration and facilitates the effective application of artificial intelligence technology in the field of social entrepreneurship.

Full Text

Research on the Mechanisms by Which Human-AI Collaboration Influences Hybrid Problem Solving in Social Entrepreneurship: Based on the Attention-Based View

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Abstract: Social entrepreneurship faces hybrid problems arising from conflicts between social and economic logics, which pose challenges to entrepreneurs' allocation of attention and make it urgent to explore effective pathways for solving

such hybrid problems. Drawing on the attention-based view, this study analyzes the mechanisms through which human–AI collaboration affects the solving of hybrid problems in social entrepreneurship, and constructs a theoretical framework of "human–AI collaboration–attention investment–hybrid problem solving in social entrepreneurship." Specifically, the study examines three modes of human–AI collaboration and their pathways of action: AI-led collaboration optimizes the efficiency of data-driven resource utilization by enhancing entrepreneurs' sustained attention investment; human-led collaboration achieves a dynamic balance among the demands of multiple stakeholders by strengthening alternating attention investment; and interactive human–AI collaboration promotes the creative integration of social and economic value through the synergy of dual forms of attention. In terms of theoretical contributions, this study deepens research on the micro-level cognitive mechanisms of hybrid problem solving in social entrepreneurship, and extends the applicable contexts and boundaries of the attention-based view and human–AI collaboration theory. In terms of practical contributions, it provides social entrepreneurs with a cognitive empowerment pathway for human–AI collaboration and facilitates the effective application of artificial intelligence technologies in the field of social entrepreneurship.

Keywords: social entrepreneurship; human–AI collaboration; problem solving; attention-based view

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Abstract: Social entrepreneurship faces hybrid problems arising from conflicts between social and economic logics, posing significant challenges to entrepreneurs' attentional allocation and necessitating effective pathways for hybrid problem-solving. Drawing on the attention-based view, this project analyzes the mechanisms through which human-AI collaboration influences hybrid problem-solving in social entrepreneurship, and proposes a theoretical framework of "human-AI collaboration–attentional engagement–hybrid problem-solving." Specifically, the study examines three modes of human-AI collaboration and their respective mechanisms: AI-dominated collaboration enhances entrepreneurs' sustained attention engagement, thus optimizing data-driven resource utilization efficiency; human-dominated collaboration strengthens alternating attention engagement, thereby facilitating dynamic balance among multiple stakeholder demands; and interactive human-AI collaboration fosters creative integration of social and economic values through dual attentional synergy. The study systematically tests these modes and mechanisms through an integrated methodological approach encompassing textual analysis, behavioral experiments, and case studies. Theoretically, this research deepens the understanding of micro-level cognitive mechanisms underlying hybrid problem-solving in social entrepreneurship, extending the application contexts and boundaries of both the attention-based view and human-AI collaboration theory. Practically, it provides social entrepreneurs with cognitively empowering pathways for human-AI collaboration, thereby facilitating effective application of AI within social entrepreneurial contexts.

Keywords: social entrepreneurship; human-AI collaboration; problem-solving; attention-based view

1 Problem Statement

As an emerging form of practice that combines a social mission with the goal of economic sustainability, social entrepreneurship has received increasing attention in the context of global sustainable development[1]. However, social entrepreneurial practice still faces many difficulties. The *2021 China Social Entrepreneurship Development Report* shows that 85% of social entrepreneurs encounter difficulties in obtaining resources, and 72% believe that social value is difficult to measure. These challenges are rooted in the essential characteristics of social entrepreneurship: hybrid problems triggered by conflicts between eco-

nomic logic and social logic[1]. Specifically, hybrid problems exhibit three prominent contradictions: first, the contradiction of hybrid value propositions between social value and economic value[2]; second, the contradiction of hybrid resource utilization between resource bricolage and resource optimization[3]; and third, the contradiction of hybrid governance between the diversity of stakeholder demands and their prioritization[4]. The combined effect of these contradictions causes social entrepreneurs to face significant cognitive tension and attentional conflict in the problem-solving process, highlighting the necessity of exploring problem-solving mechanisms specifically tailored to hybrid characteristics. Hybrid problems in social entrepreneurship

Hybrid Problem-Solving refers to the process by which social entrepreneurs, when confronted with the dual logics of society and economy, formulate solutions that accommodate hybrid logics through balancing, choice, and dynamic adjustment. Existing studies show that traditional solution approaches guided by a single logic have difficulty adapting to complex hybrid contexts[5]. Their linear modes of thinking and static methods of problem representation have insufficient explanatory power when addressing challenges such as hybrid value propositions, hybrid resource utilization, and hybrid governance. Therefore, more effective modes of hybrid problem-solving urgently need to be explored.

At the same time, artificial intelligence technologies are profoundly changing entrepreneurial behavior and outcomes[6], giving rise to a new problem-solving paradigm—human–AI collaboration[7]. Human–AI Collaboration refers to the process in which human intelligence and artificial intelligence jointly complete cognitive and decision-making tasks by combining their respective strengths—human creativity and sociality with AI's computational capability and logicality[8]. Research indicates that human–AI collaboration can effectively reduce individual cognitive load, reallocate attentional resources, and improve the efficiency of complex problem-solving and the quality of decision-making[9]. For example, on the GitHub platform, many social entrepreneurs collaborate with AI tools to develop open-source projects related to poverty alleviation and environmental protection: entrepreneurs focus on creativity and value judgment, while AI is responsible for data processing and computation. This hybrid problem-solving mode of human–AI collaboration integrates the advantages of both parties and demonstrates enormous potential for empowering social entrepreneurship. However, existing research on human–AI collaboration is mainly concentrated in traditional business contexts[9,10], and exploration of social entrepreneurship contexts remains at an early stage[11]. Because social entrepreneurship faces more complex logical conflicts and severe scarcity of attention, research findings from business contexts are difficult to transfer and apply directly. This calls for theoretical and practical research on human–AI collaboration specifically in social entrepreneurship contexts.

Although research on both human–AI collaboration and social entrepreneurship has made progress, the existing literature has not yet systematically examined the mechanisms through which human–AI collaboration influences hybrid

problem-solving in social entrepreneurship. There are mainly three shortcomings. First, studies of social entrepreneurship mostly analyze hybrid problems from the perspective of institutional logics or organizational structures, and pay relatively little attention to attentional resource allocation at the level of individual cognition. Second, although existing research on human–AI collaboration attends to cognitive interaction between humans and AI, few studies systematically analyze attentional resources as a core variable. Third, theoretical analysis remains insufficient regarding how human–AI collaboration modes adapt to different types of hybrid problems and how human and machine factors affect the effectiveness of collaboration.

Theoretically, the Attention-Based View provides an important perspective for understanding the relationship between human–AI collaboration and hybrid problem-solving in social entrepreneurship. This theory holds that attention is a scarce yet valuable cognitive resource, and that individuals or organizations must selectively focus and dynamically allocate attention among complex goals[12,13]. In social entrepreneurship contexts, entrepreneurs simultaneously face the dual goals of economy and society; the coexistence of these multiple goals intensifies the scarcity of attentional resources and the difficulty of allocation[1]. Therefore, exploring how to optimize attentional resource allocation through human–AI collaboration is key to solving hybrid problems in social entrepreneurship.

Based on the above analysis, this study focuses on the following core question: How does human–AI collaboration affect hybrid problem-solving in social entrepreneurship? Specifically, the study will focus on answering three subquestions: (1) What are the connotations of hybrid problem-solving in social entrepreneurship and human–AI collaboration? What theoretical relationship exists between the two? (2) Through which modes does human–AI collaboration influence hybrid problem-solving in social entrepreneurship? (3) What are the specific mechanisms by which different human–AI collaboration modes operate in hybrid problem-solving in social entrepreneurship? To address these research questions, this study intends, based on the Attention-Based View, to construct an integrated theoretical framework of "human–AI collaboration–attentional input–hybrid problem-solving in social entrepreneurship,"deeply analyze the mechanisms through which human–AI collaboration affects hybrid problem-solving in social entrepreneurship, deepen understanding of the functional mechanisms of attention in multi-goal problem-solving from the perspective of cognitive psychology, provide new theoretical explanations for attention-control processes in human–AI collaboration contexts, and offer theoretical guidance for the high-quality development of social entrepreneurship. This study will focus on the following work: first, clarifying the connotations of hybrid problem-solving in social entrepreneurship and human–AI collaboration, as well as the theoretical relationship between them; second, based on pathways of problem-solving, analyzing the triple logic by which human–AI collaboration affects hybrid problem-solving in social entrepreneurship; and third, revealing the mechanisms through which different human–AI collaboration modes influence hybrid problem-solving

in social entrepreneurship via attentional input mechanisms.

2 Current Status of Research in China and Abroad

2.1 Research on Hybridity in the Context of Social Entrepreneurship

Social entrepreneurship refers to the activities and processes through which social wealth is increased by creating new enterprises or managing existing organizations in innovative ways in order to discover, define, and exploit social opportunities. The core characteristics of social entrepreneurship are as follows: first, it emphasizes the opportunity recognition of social problems and resource mobilization, highlighting the value of social capital and public participation[14,15]; second, it stresses the balance between social value and economic value, that is, achieving social change through innovative means; and third, it explores cross-sector collaboration and commercialization approaches to address complex social problems[3]. Research on social entrepreneurship is the result of disciplinary intersection: the attention of new public management to civil-society forces, sociology' s exploration of innovative solutions to social problems, and entrepreneurship studies' concern with social opportunities in the bottom-of-the-pyramid (BOP) market have jointly promoted the formation of this interdisciplinary field[16,17].

Hybridity is currently at the frontier of social entrepreneurship research[5]. Hybridity is defined as "the combination of social logic and economic logic that traditionally would not be integrated" [1], and scholars have further conceptualized it as a continuum with economic logic and social logic at the two ends[2]. As typical hybrid organizations, social enterprises need to seek balance among hybrid logics[18]. Recent studies have mainly focused on three core dimensions of hybridity in social enterprises: value propositions, modes of resource utilization, and organizational governance. (1) In terms of value propositions, research examines how social entrepreneurship achieves balance within the dual identity of social mission and economic objectives. Scholars generally believe that social enterprises simultaneously pursue hybrid social and economic value[19-21], distinguishing them from the single value propositions of commercial enterprises and nonprofit organizations. Studies point out that this hybrid value proposition of social enterprises is neither purely public-welfare oriented nor purely profit oriented, but rather seeks synergy and coexistence between the two[22,23]. In the process of value creation, social enterprises need to fully consider the intrinsic linkage between social goals and economic goals, rather than simply making trade-offs[5]. This requires social enterprises to develop specific capabilities to integrate and coordinate different value-creation activities[24]; moreover, factors such as entrepreneurs' cultural backgrounds and gender also influence their understanding of hybrid value and the extent to which they pursue it[25]. (2) In terms of resource utilization, research discusses how social enterprises respond to resource scarcity in hybrid environments, including resource bricolage

and resource optimization[3]. Resource mobilization and integration are key to resource utilization in social entrepreneurship[26]. On the one hand, social enterprises adopt resource bricolage—that is, they identify and develop social entrepreneurial opportunities by creatively using existing and limited resources[27]. On the other hand, social enterprises adopt four resource-optimization strategies —resource abandonment, absorption, retention, and seeking—and, on this basis, flexibly integrate resources from different sources so as to meet the needs of both social and economic goals[14]. (3) In terms of organizational governance, the governance of hybrid organizations is particularly important because it directly affects the stability of social enterprises' missions. Research has found that the institutional diversity of boards of directors can help social enterprises better represent and integrate different logics, but it may also bring about cognitive and emotional conflicts, thereby leading to attention drift and mission deviation[4,28]. To effectively address this issue, recent research has proposed an integrated governance model with two mechanisms: protective board structures and relational leadership processes[4,29].

2.2 Related Research on Problem Solving

Problem solving is the process of eliminating the discrepancy between the current state and the goal state through information processing[30]. Research on problem solving originated from core issues in cognitive science and organizational management, and its theoretical development has evolved from the cognitive framework of individual bounded rationality to the complex adaptive path of organizational–technological collaboration. (1) Bounded rationality and problem-space theory. Simon' s (1978)[31] theory of bounded rationality laid the foundation for the classical paradigm, proposing that problem solving is a process in which individuals, under conditions of limited cognition, search for satisfactory solutions through exploration of the problem space; it emphasizes the core roles of problem definition, goal setting, and solution-space search. The dual-process theory in cognitive psychology focuses on the psychological mechanisms of bounded rationality, distinguishing cognitive activities into an intuitive system and an analytical system, and revealing individuals' switching and trade-offs between these two modes of processing in problem solving[32,33]. However, the bounded-rationality assumption relies too heavily on the independence of individual cognitive abilities, making it difficult to explain multi-agent collaboration and dynamic adaptation in complex contexts. (2) The staged and dynamic perspectives of problem solving. Lang et al. (1978)[34] proposed a staged model of problem solving, extending from problem identification to the generation and implementation of solutions, and emphasizing linear logic and feedback loops. However, through an empirical study of team problem solving, Seeger (1983)[35] found that teams do not always go through a fixed

stage; especially in familiar teams, the generation of solutions may directly bypass the problem-definition stage. This finding echoes Klein' s (1998)[36] recognition-primed decision model based on naturalistic decision making,

namely that experts tend to rely on experiential pattern recognition rather than step-by-step stage analysis. Together, these studies have promoted a shift in problem-solving research from static, stage-based models toward dynamic and adaptive models. (3) From problem representation to unstructured problems. In complex and unstructured problems, traditional linear models gradually reveal their limitations. Cognitive psychology indicates that constructing and simplifying problem representations are key links in problem solving: individuals tend to select simplified mental representations to balance cognitive load and solution performance, and this process of representational selection simultaneously shapes the flexibility and rigidity of problem solving[37]. von Hippel and von Krogh (2016)[38] further proposed the theory of "Need-Solution Pairs," arguing that problems and solutions may be discovered simultaneously, without requiring a clearly specified problem statement in advance. This theory breaks through the traditional dependence of problem solving on "problem formulation" and emphasizes the importance of exploratory cognition in solving unstructured problems[39]. (4) Problem solving and innovation. The integration of problem-solving research with innovation theory has further enriched its theoretical depth. Through research on analogical transfer, Franke et al. (2014)[40] found that the application of cross-domain knowledge can significantly enhance the novelty of solutions. Cognitive psychology, in turn, has explored the internal psychological processes of creative problem solving. On the one hand, individuals' problem-solving strategies are not fixed once and for all, but undergo a dynamic evolutionary process from error to correctness and from diverse attempts to specialized heuristic strategies[41]; on the other hand, research on insight problem solving shows that the generation of novel solutions depends not only on analytical reasoning, but also involves the coordinated regulation of unconscious processing, prototype inspiration, and executive functions[42–44]. This indicates that problem solving is not only a process of discovering solutions, but also an important component of the mechanisms through which innovation is generated. It can be seen that problem-solving theory has evolved from early individual cognitive models toward dynamic, multi-actor collaboration and cross-domain knowledge integration, gradually forming a more open and complex theoretical framework.

With technological development, human–AI collaboration, as a new paradigm of problem solving, is reshaping organizations' cognitive and decision-making modes in solving complex problems. (1) Models of human–AI collaborative problem solving. Raisch and Fomina (2025)[7] decomposed human–AI collaboration into three types of models: autonomous search, sequential search, and interactive search. Their empirical results show that AI can overcome the local-search traps of human cognition and generate "distant innovative solutions" through Latent Representation. (2) The advantages of generative AI in creative problem solving. Boussioux et al. (2024)[45] found that solutions generated through human–AI collaboration outperform purely human solutions in strategic feasibility, financial value, and environmental value, whereas humans

have greater advantages in the novelty of solutions. This suggests that human–AI collaboration can play an important role in value-oriented problem solving. (3) Organizational application and optimization mechanisms. The effective implementation of human–AI collaboration requires organizations to reconstruct management mechanisms and optimize collaborative efficiency through precise matching between task complexity and time constraints[46], marking the deepening of problem solving from the level of technical tools to the strategic level of organizational design.

Social entrepreneurial problem solving exhibits distinctiveness and complexity. (1) The hybridity of problems. The core of social entrepreneurial problem solving lies in the simultaneous pursuit of social mission and economic sustainability, and this hybrid objective creates significant tension. Social missions often conflict with economic goals, requiring coordination through the hybridity of organizational logics. For example, a charity culture emphasizes short-term relief, whereas a problem-solving culture tends toward long-term systemic solutions; the two need to be dynamically integrated within social enterprises[47,48]. In addition, the hybridity of organizational logics has been shown to effectively suppress mission drift, help social enterprises find a balance between dual goals, and enhance social impact[18]. The hybridity of problems makes social entrepreneurial problem solving more complex, but at the same time provides the possibility of realizing broader social value. (2) An ethics-driven problem-solving process. Social entrepreneurial problem solving is often centered on ethics, driving decision-making behavior through moral imagination and compassion. Compassion can motivate social entrepreneurs to attend to social problems and integrate resources, but it may also generate negative effects by neglecting costs or risks[49]. On the other hand, moral imagination helps entrepreneurs achieve balance among diverse stakeholders and ensures the fairness and sustainability of decisions through ethical reflection[50]. This ethics-driven problem solving provides deeper value support for social entrepreneurship, while also increasing its complexity. (3) Institutional embeddedness and resource mobilization. Social entrepreneurial problem solving is deeply influenced by the institutional environment and resource conditions, especially in terms of resource integration and incentive mechanisms. Research shows that government res[[unclear: text continues beyond the visible page]]

Aid plays an important role in social entrepreneurship, but after the funding period, resource integration mainly depends on the mobilizing capacity of social capital[14]. At the same time, institutional design encourages entrepreneurs to participate in solving social problems through such means as raising public awareness and setting time horizons; this institutional embeddedness provides important external support for social entrepreneurship[51].

Methods for evaluating the effectiveness of problem solving involve multidimensional approaches to measuring effects. From a results-oriented perspective, the main evaluation indicators include the novelty, practicality, and overall quality of solutions[52]. From a process-oriented perspective, the analysis focuses on

the depth dimension of knowledge exploration (deep-level cognitive processing) and the breadth dimension (span across knowledge domains), as well as the output efficiency of solutions[53]. In addition, dimensions such as the executability, strategic value, and environmental effects of solutions also constitute important components of the evaluation system[45].

2.3 Related Research on Human–AI Collaboration

Human–AI Collaboration is an important issue in the era of artificial intelligence and has attracted extensive attention from both academia and practice[54]. Research on the driving factors of human–AI collaboration shows that individuals' understanding and acceptance of artificial intelligence are jointly influenced by multiple factors. Individual psychological characteristics (concerns about online privacy, self-efficacy, reserves of professional knowledge, and egalitarian views), demographic variables (gender and age), human–AI collaboration contexts (the influence of AI participation in decision making and application scenarios), and cultural backgrounds (country, organizational culture, personal values, and religious beliefs) all exert important effects on subjective perceptions of AI in terms of usefulness, fairness, and potential risks, thereby shaping individuals' attitudes toward accepting it[55-57].

Current research focuses on the process of human–AI collaboration, with particular attention to key issues such as its stage division, collaborative characteristics, interaction modes, and design principles for collaboration. The process of human–AI collaboration reflects the dynamic interaction of agency between humans and technology; influenced by past experience, present context, and future expectations, it exhibits the dynamism and temporality characteristic of practical activities[58,59]. The process through which organizations solve problems by means of human–AI collaboration can be divided into three stages: pre-search, search, and post-search[7]. In this process, human–AI interaction displays the characteristics of complementary capabilities, knowledge integration, and continuous learning and adaptation[7,8]. Humans rely on professional knowledge, creativity, and contextual understanding to evaluate and screen the computational and search results produced by machines; machines, by learning from human feedback, continuously improve problem representations and solutions. Through interaction, the two sides integrate each other' s knowledge, produce outcomes that are more innovative and integrative, and continuously adjust behavioral strategies to adapt to changing problem contexts[60]. Scholars generally believe that human–AI collaboration can take two modes: augmentation or automation[61,62]. The former refers to humans and machines working closely together to complete tasks, while the latter means that machines replace humans and independently perform work tasks; in managerial practice, the two present a paradoxical relationship of contradiction and interdependence[10]. Organizations need to balance the tension between automation and augmentation and achieve a virtuous cycle through differentiation and integration[63]. It is worth noting that complex conceptual dualities and relational duality effects ex-

ist in the process of human–AI collaboration[64]. Conceptual dualities include, for example, positive/negative emotions and increases/decreases in team knowledge, while relational dualities include changes in decision quality and critical ability, work speed and cognitive load, and so forth. In the face of the complex effects in the process of human–AI collaboration, organizations need to adopt corresponding strategies and principles in order to realize complementarity of human and machine advantages and advance collaboratively. On the one hand, the design of human–AI collaboration must take into account three key domains: machine design, collaboration design, and institutional design[64]; on the other hand, organizations need to follow six principles in designing human–AI collaboration: rationally allocating intelligent resources, accurately assigning tasks, optimizing substitution strategies, promoting participant diversity, enhancing collaboration skills, and ensuring algorithmic interpretability and accountability.

From the perspective of psychology, research on human–AI collaboration mainly focuses on three major issues: human–AI trust, cognitive load, and psychological perception, providing an important foundation for understanding individual cognitive processes in human–AI interaction. First, human–AI trust is the psychological foundation for successful human–AI collaboration. Glikson and Woolley (2020)[65] systematically reviewed the determinants of human–AI trust, revealing the differentiated effects of AI' s tangibility, reliability, and anthropomorphism on cognitive trust and affective trust. Based on the human–machine projection hypothesis, the research explains the psychological mechanism by which individuals understand and interact with robots from the standpoint of their own cognitive, affective, and action intelligence[66]. Further studies show that individuals' self-confidence, more than their confidence in AI, determines whether they accept AI advice[67], while both overtrust and insufficient trust can hinder collaboration and therefore need to be calibrated through the dual pathways of trust suppression and trust enhancement[68,69]. Second, cognitive load is a key psychological variable affecting the effectiveness of human–AI collaboration. Studies have found that indicators such as primary-task reaction time and gaze behavior are related to cognitive load

is sensitive to changes in cognitive load, and multidimensional integrated assessment models can more effectively measure levels of cognitive load in human–machine interaction[70]. On this basis, decision control and explanation mechanisms can enhance user trust and compliance by reducing cognitive load[71]. Third, psychological perception and responsibility attribution shape human–machine collaborative behavior. Anthropomorphism promotes users' positive attitudes toward AI by shortening psychological distance[72], while mind perception determines whether a technology can be regarded as a true team member[73]. However, human–machine collaboration may also, through the mediating role of perceived agentic responsibility, make individuals more risk-seeking in risky decision-making[74], and may even induce social loafing and responsibility shifting[75,76].

2.4 Related Research on the Attention-Based View

Attention research is a core issue in cognitive psychology. Kahneman (1973)[77] systematically discussed attention as an allocation mechanism for limited cognitive resources, pointing out that individuals must, at any given moment, trade off resources among multiple tasks. This laid the micro-foundation for research on attention at the organizational level. The attention-based view (Attention-Based View, ABV), proposed by Ocasio (1997)[13], is a theoretical framework for explaining organizational behavior and decision-making. Its central claim is that firm behavior is the result of how firms guide and allocate the attention of decision-makers. This theory breaks through the limitations of traditional rational choice theory and provides a more behaviorist perspective for explaining organizational decision-making processes[78,79]. ABV theory is built on three interrelated principles: the principle of focus of attention, the principle of situated attention, and the principle of structural distribution of attention. Together, these principles explain how attention becomes a bridge linking cognition and action[80]. In essence, the attention-based view is a theoretical attempt to elevate the micro-level assumptions in cognitive psychology regarding the limited and selective nature of attention to the organizational level[81].

From the perspective of cognitive neuroscience, attention is not a unitary construct, but is composed of multiple functionally relatively independent subsystems. Posner and Petersen (1990)[82] proposed a three-function architecture of the attention system, namely orienting, alerting, and executive control. The hierarchical model of attention proposed by Sohlberg and Mateer (1987)[83] in the tradition of clinical neuropsychology divides attention into five progressive levels: focused attention, sustained attention, selective attention, alternating attention, and divided attention. Drawing on findings from cognitive neuroscience, Ocasio (2011)[84] divided organizational attention into three forms: attentional perspective, attentional engagement, and attentional selection. First, attentional perspective refers to top-down cognitive and motivational structures that guide attention to relevant stimuli and responses over the long term. Second, attentional engagement refers to the process of consciously and continuously allocating cognitive resources to guide problem solving, planning, meaning construction, and decision-making. Attentional engagement contains two core elements: alternating attention and sustained attention[83]. The former refers to an individual' s ability to flexibly switch among multiple goals, plan tasks, and resolve conflicts; the latter refers to an individual' s ability to concentrate on a particular goal or task for an extended period of time, especially in situations requiring long-term investment and patience[84]. Third, attentional selection refers to the outcome of automatic or conscious attentional processes, whereby attention is ultimately directed toward specific stimuli while other stimuli are excluded.

Sustained attention is rooted in the cognitive-psychological research tradition on vigilance. Mackworth (1948)[85] first characterized the phenomenon of vigilance decrement, namely the regular decline in detection accuracy over time

when individuals perform prolonged monitoring tasks. Subsequent studies have shown that the neural basis of sustained attention involves the right frontoparietal network and the basal forebrain cholinergic system[86,87]. Its decline stems both from the depletion of cognitive resources and from failures of attentional control triggered by mind-wandering[88,89]. Unlike selective attention, which emphasizes filtering along spatial or object dimensions, sustained attention emphasizes the persistent maintenance of a target over the temporal dimension.

Alternating attention, in turn, is rooted in the cognitive-psychological research tradition on task switching. Monsell (2003)[90] noted that when individuals switch between different tasks, they incur a significant switch cost, which is essentially the cognitive cost required for task-set reconfiguration. Switch costs arise from multiple factors, including task-set inertia, cue–task associations, and the reorientation of attentional focus[91,92]. From the perspective of executive function, alternating attention is closely related to cognitive flexibility and represents the core manifestation of the "switching" component of executive function[93]. Unlike divided attention, which involves simultaneously processing multiple tasks, alternating attention emphasizes sequential, conscious attentional foc-

redirection of focus.

The attention-based view emphasizes that attention is the mediating mechanism linking cognition and behavior. The choice of attentional focus directly affects how managers perceive and respond to external events. Ocasio (1997)[13] proposed that the structural allocation of attention can explain why firms exhibit different behavioral responses when facing the same environment. In addition, the allocation of attention not only influences individual behavior, but also shapes organizational behavior through group interaction. Studies show that the dispersion and redundancy of attention may lead to delayed decision-making or behavioral failure when organizations respond to complex problems[94].

Attention allocation plays a decisive role in the problem-solving process. From the perspective of cognitive psychology, the way individuals engage attention in problem solving affects the solution strategies they adopt, forming two main pathways: problem orientation (attention to framing) and solution orientation (attention to implementation)[95]. From the perspective of dynamic capabilities, the interaction between attentional control (guiding attention) and problem solving (identifying root problems) constitutes the core mechanism by which organizations adjust their day-to-day capabilities[96]. The interaction between attention and social network structure shapes different problem-solving pathways. Individuals in highly constrained networks tend to adopt an "inquiry logic," concentrating attention on specific information sources; by contrast, individuals in low-constraint networks adopt a "recombination logic," dispersing attention across multiple information sources[97]. From the perspective of entrepreneurial cognition in management psychology, entrepreneurs' allocation of attention directly affects their opportunity recognition and decision quality. Mitchell et al. (2002)[98] defined entrepreneurial cognition as the knowledge

structures and information-processing processes used by entrepreneurs in opportunity evaluation and value creation; Baron (2007)[99] further pointed out that entrepreneurs' cognitive characteristics shape how they selectively attend to and interpret environmental stimuli. Subsequent studies have found that entrepreneurial alertness, patterns of attentional investment, and cognitive flexibility all significantly influence entrepreneurs' perception and judgment of opportunities[100,101]. When managers attend to multiple strategic issues at the same time, attention to alternative issues weakens the link between attention to focal issues and action[94]. This "attention dispersion" effect is especially pronounced in small organizations with limited resources, indicating that attention is a scarce resource and that its effective allocation is crucial to problem solving. Because of its profound insights into cognition and behavior, the attention-based view has been widely applied in strategic management[94,102], innovation and entrepreneurship[103], social entrepreneurship, and other fields.

2.5 Deficiencies in Existing Research

(1) There is a lack of systematic exposition of the problem-solving process in the hybrid context of social entrepreneurship. Although existing research has explored in depth the hybridity characteristics of social entrepreneurship and has examined multiple dimensions such as hybrid identities, hybrid forms, and hybrid environments[1,2,18], insufficient attention and systematic research have been devoted to the process mechanisms by which social entrepreneurs conduct problem solving in actual decision-making contexts. Specifically, much of the existing literature discusses the characteristics and challenges of hybrid organizations from a static perspective—such as identity conflict and legitimacy challenges—or focuses on logic classification and conceptual demarcation at the theoretical level[5,104], while neglecting research on the cognitive mechanisms involved in handling conflicts among multiple logics and achieving dynamic cross-logic trade-offs and integration in the problem-solving process, such as attentional selection, allocation, and transfer. In addition, existing literature employs relatively singular measurement methods for hybrid problem solving in social entrepreneurship, lacking an integrated measurement framework covering problem types, process dimensions, and outcome dimensions. As a result, it is difficult to fully reflect the complexity and dynamism of hybrid problem solving in social entrepreneurship.

(2) The mechanism through which human–AI collaboration affects hybrid problem solving in the context of social entrepreneurship remains unclear. Current research on human–AI collaboration mostly focuses on general organizational settings, emphasizing human–AI interaction processes, collaboration modes, and outcomes[7,64]. Very few studies place human–AI collaboration within the special context of social entrepreneurship, and there is a particular lack of in-depth discussion of how human–AI collaboration influences social entrepreneurship in solving complex hybrid

problems. Social entrepreneurship faces hybrid challenges in which social missions and economic goals coexist, and this hybridity makes the problem-solving process more complex[5,48]. Although existing studies indicate that human–AI collaboration can improve organizational decision quality and innovation capability[45], there is still a lack of in-depth analysis of the mechanisms through which it helps social enterprises identify, weigh, and integrate multiple goals in order to achieve hybrid value. Therefore, it is urgent to examine the influencing mechanisms of hybrid problem solving in the context of social entrepreneurship from the perspective of human–AI collaboration, so as to clarify how artificial intelligence promotes the hybrid problem-solving capability of social entrepreneurship organizations through the guidance, allocation, and focusing of attention.

(3) The application of the attention-based view in explaining the process through which human–AI collaboration affects hybrid problem solving in social entrepreneurship

research remains insufficient. Although the attention-based view has been widely applied in fields such as strategic management and innovation and entrepreneurship

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, existing studies have rarely linked it with problem solving in human–machine collaboration, and such work is especially scarce in the context of social entrepreneurship. The attention-based view emphasizes that organizational behavior is the outcome of the structural allocation of managers' attention

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. When social enterprises confront hybrid problems, however, they often face challenges such as difficulties in attention allocation and decision-making biases

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. Most existing studies remain at the level of analyzing the hybridity problems of social entrepreneurial organizations from the perspective of the attention configuration of management teams

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, with relatively little examination, at the organizational level, of how human–machine collaboration reshapes the structural allocation of attention and thereby optimizes the process through which social entrepreneurial organizations solve hybrid problems. Therefore, future research needs to further clarify the theoretical value of the attention-based view in explaining the influence of human–machine collaboration on hybrid problem solving in social entrepreneurship, and to reveal how collaborative mechanisms between artificial intelligence and humans enhance the decision-making and action effectiveness of social entrepreneurial organizations through the structural configuration of attention at the organizational level.

(4) The integration of the micro-level attentional mechanisms of cognitive psychology into human–machine collaboration contexts is insufficient. Unlike the attention-based view, which offers a macro-level discussion of attentional configuration at the organizational level, research in cognitive psychology on individual attentional processing mechanisms remains relatively weak in its application to the question of how human–machine collaboration affects the solving of hybrid problems in social entrepreneurship. On the one hand, classic studies in cognitive psychology have mostly revealed the processing laws of attention through paradigms such as vigilance decrement

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and task-switching costs

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; however, how these micro-level cognitive mechanisms are manifested in real entrepreneurial decision-making involving AI still lacks systematic examination. On the other hand, although entrepreneurial cognition research has already attended to entrepreneurs' information-processing processes

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, it has paid insufficient attention to differences in the processing of individuals' sustained and alternating attention. More importantly, there remains a lack of systematic psychological investigation into how the trade-off between sustained and alternating attention is reconstructed at the level of individual cognitive processing under AI intervention, and how it in turn affects the dual pursuit of social value and economic value.

3 Research Conception

Taking the attention-based view as its theoretical perspective, this study centers on the core question of "how human–machine collaboration affects the solving of hybrid problems in social entrepreneurship." First, it begins with a conceptual analysis of human–machine collaboration and hybrid problem solving in social entrepreneurship, and with the construction of a theoretical framework, clarifying the connotations, classifications, and measurement of the two. On the basis of the attention-based view, it then elucidates the logical relationship between them and constructs an integrated theoretical framework accordingly (Research Content 1). Second, it focuses respectively on three typical modes of human–machine collaboration—AI-led collaboration, human-led collaboration, and human–machine interactive collaboration—and explores in depth the relationships between different collaboration modes and social entrepreneurs' attentional investment, as well as how attentional-investment mechanisms influence the process and outcomes of solving hybrid problems in social entrepreneurship (Research Contents 2 to 4). The overall research framework of this study is shown in Figure 1:

Translated text in Figure 1

- **Research Content One: Conceptual analysis and theoretical framework**
  - Connotation and classification of human–AI collaboration
  - Theoretical connections and research framework based on the attention-based view
  - Conceptual analysis of social entrepreneurship hybrid problem solving
- **Research Content Two: Solution-focused strategy**
  - AI-led collaboration
  - **Problem types**
    - Degree of hybridity
    - Degree of structuredness
  - **Human–AI factors**
    - Entrepreneurs' professional knowledge
    - AI explainability
    - Human–AI trust
  - **Attention investment**
    - Sustained attention
- **Research Content Three: Problem-focused strategy**
  - Human-led collaboration
  - **Human–AI factors**
    - Entrepreneurs' cognitive style
    - Entrepreneurs' affective state
    - Human–AI cognitive alignment
  - **Attention investment**
    - Alternating attention
- **Research Content Four: Problem–solution matching strategy**
  - Human–AI interactive collaboration
  - **Human–AI factors**
    - Depth of AI participation
    - Human–AI trust
    - Frequency of human–AI interaction
  - **Attention investment**
    - Alternating attention
    - Sustained attention
- **Social entrepreneurship hybrid problem solving**
  - Hybrid value problems
    (social value, economic value)
  - Hybrid resource utilization problems
    (resource bricolage, resource optimization)
  - Hybrid governance problems
    (diversity and priority of stakeholder needs)

Figure 1. Research framework for the mechanism by which human–AI collaboration influences social entrepreneurship hybrid problem solving

3.1 Research Content One: Conceptual Analysis and Theoretical Framework of Human-AI Collaboration and Social Entrepreneurship Hybrid Problem Solving

Research Content One aims to construct a theoretical foundation framework for human-AI collaboration and social entrepreneurship hybrid problem solving. This part seeks to answer three research questions: How should human-AI collaboration be defined? How should social entrepreneurship hybrid problem solving be defined? What is the relationship between the two? In response to these questions, the research proceeds at three levels: first, clarifying the concept and classification of human-AI collaboration, especially its particularities in the context of social entrepreneurship; second, specifying the conceptual boundaries, type classification, and measurement methods of social entrepreneurship hybrid problem solving; and third, exploring the theoretical connections between human-AI collaboration and social entrepreneurship hybrid problem solving based on the attention-based view. Through the above research, a theoretical foundation is laid for subsequent in-depth exploration of the mechanisms of action of different collaboration modes. The research framework is shown in Figure 2.

Translated text in Figure 2

- **Conceptual analysis and theoretical framework of human-AI collaboration and social entrepreneurship hybrid problem solving**
  - **Human-AI collaboration**
    - Conceptual connotation
    - Core characteristics
    - Mode classification
  - **Attention-based view**
  - **Social entrepreneurship hybrid problem solving**
    - Conceptual connotation
    - Problem types
    - Measurement methods
  - **Theoretical connections based on the attention-based view**
    - Cognitive load transfer
    - Attention investment
    - Hybrid-logic trade-offs
    - Attention allocation

Figure 2. Conceptual analysis and theoretical framework of human-AI collaboration and social entrepreneurship hybrid problem solving

(1) The Concept and Modes of Human-AI Collaboration Human-AI Collaboration refers to the process in which human intelligence and artificial intelligence jointly complete cognitive and decision-making tasks by combining their respective advantages—human creativity and sociality, and AI' s computational capability and logicality.[8] Human-AI collaboration in the context of social entrepreneurship differs from human-AI collaboration in commercial en-

trepreneurship scenarios, mainly in the following three respects. First, in terms of hybrid value orientation, human–AI collaboration in social entrepreneurship must seek a balance among hybrid goals such as social mission and economic sustainability; such hybrid goals have brought about

significant cognitive tension[48]. Second, because of high contextual dependence, social problems are usually deeply embedded in complex sociocultural contexts; this requires AI systems to be capable of understanding specific sociocultural backgrounds rather than relying solely on universal algorithms[54]. Finally, because of the presence of multiple stakeholders, social entrepreneurial decision-making involves coordination and balance among diverse stakeholders; human–AI collaboration must therefore be able to integrate the needs and interests of different groups[49,50].

As shown in Figure 3, according to the characteristics of human–machine division of labor, human–AI collaboration can be divided into three modes: AI-led collaboration, human-led collaboration, and human–AI interactive collaboration[7]. First, AI-led collaboration adopts a Solution-Focused Strategy: AI first independently performs problem definition and solution generation, producing distant innovative solutions, after which humans screen and optimize the solutions. This strategy is suitable for scenarios with abundant data and highly structured problems. Second, human-led collaboration adopts a Problem-Focused Strategy: AI first proposes representations and frames of social problems, and humans then search for solutions based on the problem frames provided by AI. This strategy helps social entrepreneurs break through cognitive limitations and think about problems from a broader perspective. Third, human–AI interactive collaboration is a mode in which humans and AI collaborate as equals and adopt a Problem–Solution Pair Strategy: humans and AI interact continuously during the search process, dynamically integrating knowledge and feedback and iteratively optimizing problem–solution pairings[38]. This strategy is suitable for solving social problems characterized by high complexity and strong uncertainty.

AI-led collaboration
(solution-focused)

AI independently generates solutions → solution → humans screen solutions

Human-led collaboration
(problem-focused)

AI proposes a problem frame → problem frame → humans search for solutions

Human–AI interactive collaboration
(problem–solution pairing)

AI continuous iteration problem–solution pairing dynamic optimization humans

Figure 3. Human–AI collaboration modes and processes

(2) The concept and measurement of hybrid problem solving in social entrepreneurship

The connotation of hybrid problem solving in social entrepreneurship. Hybrid problem solving in social entrepreneurship refers to the process by which social entrepreneurs, when facing hybrid problems in which social logic and economic logic are intertwined, formulate solutions that can effectively accommodate hybrid logics through trade-offs, choices, and dynamic adjustment. In essence, this process is the strategic allocation of organizational attention resources; it is manifested as a dynamic adaptive mechanism through which entrepreneurial actors continuously adjust decision-making priorities amid goal conflicts, resource constraints, and governance dilemmas. Its core contradictions can be deconstructed into three dimensions. First, the contradiction of hybrid value propositions: the balancing of tensions between social value and economic value. Social logic emphasizes solving social problems and creating public welfare, and is characterized by long-term orientation and difficulty of quantification; economic logic, by contrast, focuses on financial performance and short-term returns, and is oriented toward market mechanisms and efficiency indicators. Social entrepreneurs must continuously weigh and dynamically adjust between these two value orientations in order to balance mission-driven goals with economic sustainability. Second, the contradiction of hybrid resource utilization: strategic coordination between resource bricolage and resource optimization. Under conditions of resource constraint, social entrepreneurs face strategic-choice difficulties in how to use resources.

circumstances: resource bricolage emphasizes the creative use of existing resources, embodying flexibility and adaptability; resource optimization, by contrast, pursues the systematic integration of standardized resources, emphasizing efficiency gains and economies of scale. Social entrepreneurs need to balance innovative flexibility with organizational efficiency under resource constraints. Finally, there is the contradiction of hybrid governance: the integration of the demands of multiple stakeholders. Faced with the interests and demands of governments, communities, clients, investors, and other parties, social entrepreneurship organizations need to make appropriate arrangements in their governance structures and decision-making mechanisms, establish flexible institutional "guardrails," and dynamically adjust the priorities of all parties so as to coordinate multiple interests and maintain organizational legitimacy. The process of resolving these three layers of contradiction constitutes the core content of solving hybrid problems in social entrepreneurship, requiring social entrepreneurs to possess capabilities for sustained innovation and dynamic adaptation.

Classification of hybrid problems in social entrepreneurship. Drawing on hybridity theory[1] and the AI adaptive decision-making framework[7], this study deconstructs the types of hybrid problems from the dual dimensions of goals and tasks. First, goal characteristics: high hybridity and low hybridity. The level of hybridity depends not only on the relative weights of economic logic and social

Figure 4. Classification framework for hybrid problems in social entrepreneurship. The vertical dimension is goal characteristics, ranging from high hybridity to low hybridity; the horizontal dimension is task characteristics, ranging from unstructured to structured. The quadrants are I, II, IV, and III.

Figure 1: Figure 4. Classification framework for hybrid problems in social entrepreneurship. The vertical dimension is goal characteristics, ranging from high hybridity to low hybridity; the horizontal dimension is task characteristics, ranging from unstructured to structured. The quadrants are I, II, IV, and III.

logic, but also on the strength of the two logics[2]. When the relative importance of economic logic and social logic tends toward balance, the degree of hybridity increases; conversely, when one logic occupies a dominant position while the other plays only an auxiliary role, the degree of hybridity is lower[108]. The degree of hybridity of a problem can be measured by the intensity of conflict among goals and the difficulty of integrating different logics[1]. Second, task characteristics: structured and unstructured. Drawing on Simon' s (1973)[109] problem-classification theory, this study divides hybrid problems, from the dimension of task characteristics, into structured problems and unstructured problems. Structured hybrid problems have clear boundaries, explicit relationships among variables, and quantifiable objective functions; unstructured hybrid problems, by contrast, have ambiguous definitions, highly subjective value trade-offs, and complex relationships among variables. Structured problems can be solved efficiently with algorithmic assistance, whereas unstructured problems must rely on the dynamic representational reconstruction enabled by human–machine collaboration, transforming them into operable forms[38]. As shown in Figure 4, by crossing the two dimensions of goal characteristics and task characteristics, this study constructs a 2×2 classification matrix of hybrid problems, containing four typical types of hybrid problems. Type I problems are hybrid problems with high hybridity and unstructured tasks; Type II problems are hybrid problems with high hybridity and structured tasks; Type III problems are hybrid problems with low hybridity and structured tasks; and Type IV problems are hybrid problems with low hybridity and unstructured tasks. Each type corresponds to different cognitive challenges and decision-making characteristics, and this classification helps to understand the applicability and effectiveness of human–machine collaboration in different hybrid-problem contexts.

Figure 4 Classification framework for hybrid problems in social entrepreneurship

Measurement methods for the effectiveness of solving hybrid problems in social entrepreneurship. Measuring the effectiveness of solving hybrid problems is an important foundational component of this study, aiming to scientifically evaluate, from multiple dimensions, the actual effectiveness of social entrepreneurship in solving hybrid problems. First, indicators for the effectiveness of solving hybrid value problems: social value, economic value, and value balance. Social value uses social impact as the measurement indicator, reflecting the actual ef-

fectiveness of social enterprises in meeting social needs or solving social problems. Specifically, it can be quantified by assessing dimensions such as the scale of the social problems solved, the number of target groups covered, or the depth of services provided[110,111]. Economic value uses indicators such as revenue growth rate and return on investment

economic performance indicators. Value balance assesses the degree of coordination between social value and economic value, and is measured by constructing an index based on the weight ratio of social value to economic value. Second, indicators of the effectiveness of hybrid resource utilization: the effectiveness of resource bricolage and the effectiveness of resource optimization. The effectiveness of resource bricolage measures social entrepreneurs' ability to use non-traditional resources, reflecting their innovativeness and capacity for low-cost resource integration; specific indicators include the resource reuse rate and the external-resource utilization rate. Resource-optimization capability evaluates social entrepreneurs' ability to optimize existing resources and improve efficiency, and can be measured by resource-use efficiency[^3]. Third, indicators of the effectiveness of solving hybrid governance problems: mission drift and stakeholder satisfaction. Mission drift is an important indicator for measuring the extent to which social entrepreneurial organizations maintain a balance of priorities amid hybrid logics[^107]. It can be quantitatively analyzed through the degree of deviation in the decision-making process, such as the rate of change in the priority of social goals or a deviation index. Stakeholder satisfaction evaluates the degree to which multiple stakeholders are satisfied with organizational decisions and actions, and can be comprehensively assessed through questionnaire surveys or qualitative interviews.

(3) The theoretical linkage between human–machine collaboration and hybrid problem solving in social entrepreneurship based on the attention-based view

On the one hand, hybrid problem solving in social entrepreneurship is, in essence, a process of attention selection and allocation. First, the hybridity of social entrepreneurship contains value conflicts and trade-offs among different logics[^1]. The core feature of social entrepreneurship lies in the simultaneous pursuit of social value and economic value, yet these two goals often involve inherent tensions[^108]. Social entrepreneurs need to make continuous trade-offs, maintain balance, and achieve integration between economic logic and social logic. The essence of this process of trade-off and integration is precisely the dynamic guidance and allocation of attentional resources across different logics[^107]. Second, the core assumption of the attention-based view is the scarcity of attention. Attention is a limited cognitive resource; the cognitive resources that each individual and organization can use for information processing within a particular time and space are limited[^13]. In the context of social entrepreneurship, the coexistence and conflict of hybrid goals such as social and economic goals make it especially necessary for social entrepreneurs to confront the problem of attention scarcity[^1]. In other words, social entrepreneurs cannot give equal

attention to all problem dimensions and all goals at the same time; they must engage in selective focus and dynamically allocate attentional resources. For example, when social entrepreneurs face resource scarcity and the risk of mission drift, their attention must be selectively focused and dynamically adjusted between social value and economic sustainability, so as to effectively coordinate conflicts among different logics and form feasible solutions. Third, from the perspective of the theoretical construct of attentional investment[^84], the process of hybrid problem solving in social entrepreneurship can be deconstructed as a dynamic combination of alternating and sustained attention. Alternating attention helps social entrepreneurs switch flexibly among multiple tasks and multiple goals, enabling short-term rapid trade-offs and decisions; sustained attention helps social entrepreneurs focus on social goals and problem solving over long periods, maintaining the strategic consistency and long-term stability of decision making[^95]. On this basis, this study operationally defines the two types of attention as follows: alternating attention refers to the degree to which social entrepreneurs invest cognitive resources in switching among multiple goals, such as social logic and economic logic, during human–machine collaboration. Its core indicators include switching frequency, switching cost, and post-switching recovery efficiency. In the context of social entrepreneurship, alternating attention is manifested specifically in social entrepreneurs' ability to weigh social-benefit indicators and economic-benefit indicators in parallel within the same decision-making situation; to switch flexibly between resource-bricolage and resource-optimization strategies, and to dynamically shift between the creative use of existing resources and the systematic integration of standardized resources according to different project contexts; and, when communicating with different stakeholders such as governments, community residents, investors, and beneficiary groups, to quickly switch discourse systems and evaluation frameworks. Sustained attention refers to the degree of cognitive investment with which social entrepreneurs maintain focused processing of a specific goal logic during human–machine collaboration. Its core indicators include the duration of attention maintenance, the rate of attention decay, and the frequency of task disengagement. In the context of social entrepreneurship, sustained attention is manifested specifically in social entrepreneurs' sustained commitment to and concern for the core social mission during long-cycle processes of social problem solving, thereby avoiding mission drift caused by short-term economic pressure; in their ability to remain focused on established social-value goals when facing assimilation pressures from market logic or temptations of commercial interests; and in their deep empathy for, and long-term tracking of, the needs of specific vulnerable groups, reflected as enduring concern and systematic investment in the pain points of core beneficiary groups. It can therefore be seen that social entrepreneurs achieve effective guidance of scarce attentional resources within complex goal systems precisely through the dynamic combination of alternating and sustained attention.

guidance and allocation.

On the other hand, human–machine collaboration is a process of reallocating

and optimizing attentional resources; that is, through mechanisms of human–machine task allocation and cognitive-load transfer, it influences how social entrepreneurs invest their attention. First, human attention is a scarce and limited cognitive resource[13]. According to Sweller' s (1988)[112] cognitive load theory, the capacity of human working memory is extremely limited. Cognitive load can be divided into three categories: intrinsic cognitive load arising from task complexity, extraneous cognitive load arising from the way information is presented, and germane cognitive load serving schema construction. In traditional decision-making contexts, social entrepreneurs must independently complete all cognitive tasks, including information processing, problem framing, solution generation, and decision optimization. Such a state of high cognitive load often causes entrepreneurs' attentional resources to be heavily occupied by foundational cognitive tasks, limiting their attention to strategic thinking and higher-order cognitive tasks[95], and readily triggering failures of attentional control, mind wandering, and vigilance decrement[88,89].

Second, the essence of human–machine collaboration is a process of task allocation and cognitive-load transfer between humans and artificial intelligence[7]. As an external cognitive support system, AI uses distributed cognitive mechanisms to externalize into the human–machine system part of the cognitive work that was originally processed entirely within humans, thereby systematically changing the structure of human cognitive load. On the one hand, by undertaking basic processing tasks such as information retrieval, data computation, and pattern recognition, AI significantly reduces entrepreneurs' extraneous cognitive load and frees up working-memory resources. On the other hand, by providing problem-representation scaffolds and decision-support interfaces, AI indirectly regulates the manageability of intrinsic cognitive load, enabling multiple objectives that were originally difficult to process simultaneously to enter the focus of attention in a modular manner. This reshaping of the cognitive-load structure directly reconstructs human patterns of attention allocation and attentional control. When some cognitive tasks are undertaken by AI, humans can invest the released attentional resources in higher-level value judgment, strategic thinking, and ethical review, thereby realizing a transformation from passive, reactive attentional control to active, selective attentional control[82,93].

In the collaboration process, artificial intelligence can undertake some cognitive tasks that were originally completed independently by social entrepreneurs, such as information processing, problem definition, and solution generation, thus significantly reducing social entrepreneurs' cognitive burden on these foundational tasks[46]. In other words, through human–machine task allocation, AI assumes part of the cognitive load and thereby frees entrepreneurs' limited attentional resources. Moreover, different modes of human–machine collaboration differ markedly in the type and degree of cognitive-load transfer, and therefore produce differentiated effects on how social entrepreneurs' attentional resources are released and allocated, thereby reshaping entrepreneurs' attentional perspectives[9]. Specifically (see Table 1): in an AI-dominant collaboration mode, the AI system undertakes the primary cognitive load, including complex tasks

such as problem identification, information analysis, and solution generation; entrepreneurs only need to screen and optimize the solutions generated by AI. This transfer of cognitive load frees entrepreneurs' attention for long-term strategic thinking and value judgment, forming a bottom-up attentional perspective. In a human-dominant collaboration mode, the AI system focuses on clarifying the problem framework and defining the boundaries of the problem, while entrepreneurs concentrate their attention on identifying and exploring specific solutions. In this situation, AI undertakes the cognitive load of problem structuring, thereby guiding entrepreneurs to focus on rapid judgment and decision-making tasks for short-term problems, forming a top-down attentional perspective. In an interactive human–machine collaboration mode, humans and AI continuously interact at different stages of problem solving, and the transfer and sharing of cognitive load are dynamic and interactive. The two sides continuously exchange information, feedback, and knowledge, constantly reconstructing problems and iterating solutions, which enables entrepreneurs' attentional resources to be dynamically optimized and reallocated at the same time. This collaboration mode not only releases entrepreneurs' limited cognitive resources, but also optimizes their overall understanding and cognitive ability regarding problem–solution relationships through a continuous interaction mechanism, forming an integrated top–bottom (Interactive) attentional perspective. It can be seen that human–machine collaboration is essentially not simply task division or knowledge exchange; rather, through cognitive-load transfer and task reallocation, it releases and reallocates social entrepreneurs' limited attentional resources. In this process, AI is no longer merely an instrumental task executor, but a cognitive partner that, by restructuring the human cognitive-load structure and regulating the patterns and modes of attentional allocation and control, can promote the dynamic and collaborative reallocation of attentional resources between humans and machines, enabling social entrepreneurs to invest their attention more effectively.

Table 1. Human–AI Collaboration Modes and Their Attention Perspectives

Collaboration mode	Problem-solving strategy	Attention perspective	Typical application scenarios
AI-led collaboration	Solution-focused strategy	Bottom-up (Bottom-Up)	Data-intensive and highly structured scenarios, such as quantitative assessment of social impact, precise matching of poverty-alleviation resources, and risk early warning for public-welfare projects
Human-led collaboration	Problem-focused strategy	Top-down (Top-Down)	Scenarios requiring value judgment and contextual understanding, such as diagnosis of community needs, identification of stakeholder demands, and delineation of the boundaries of social problems

Collaboration mode	Problem-solving strategy	Attention perspective	Typical application scenarios
Human–AI interactive collaboration	Problem–solution matching strategy	Combined top-down/bottom-up (Interactive)	Scenarios with high uncertainty and high hybridity, such as complex social innovation projects, exploration of cross-boundary collaboration models, and long-term sustainable development planning

In summary, following the attention-based view, this study identifies the theoretical linkage between human–AI collaboration and hybrid problem solving in social entrepreneurship (see Figure 5). Specifically, through mechanisms of task allocation and cognitive-load transfer, human–AI collaboration reshapes social entrepreneurs' attention perspectives, thereby influencing attention investment. Meanwhile, because hybrid problem solving in social entrepreneurship involves conflicts and trade-offs between economic logic and social logic, entrepreneurs are required to dynamically select and allocate their limited attention resources. Therefore, a theoretical linkage centered on "attention" is implicit between human–AI collaboration and hybrid problem solving in social entrepreneurship. Based on the above theoretical linkage, this study constructs an integrative research framework centered on "human–AI collaboration–attention investment–hybrid problem solving in social entrepreneurship," laying a theoretical foundation for subsequent research.

Figure 5. Theoretical linkage between human–AI collaboration and hybrid problem solving in social entrepreneurship from an attention-based view

- Human–AI collaboration → Human–AI task allocation and cognitive-load transfer → Reshaping entrepreneurs' attention perspectives → Social entrepreneurs' attention investment

- Hybrid problem solving in social entrepreneurship → Conflict and trade-off of hybrid logics → Scarcity of attention → Social entrepreneurs' attention investment

3.2 Research Content II: Solution Focus: The Hybrid Problem-Solving Mechanism of AI-Led Collaboration

Research Content II focuses on the AI-led collaboration mode and explores its mechanism of action in hybrid problem solving in social entrepreneurship, aiming to answer the research question: "How does AI-led collaboration affect hybrid problem solving in social entrepreneurship?" To this end, this part of the study includes three aspects: first, analyzing the mechanism by which AI-led collaboration acts on hybrid problem solving in social entrepreneurship; second, exploring the mediating effect of social entrepreneurs' sustained attention investment; and finally, examining the moderating roles of human–AI factors (entrepreneurs' professional knowledge, AI explainability, and human–AI trust) and problem types (hybridity and structuredness). The research framework is shown in Figure 6.

Figure content (translated):

- **Problem type**
  - Degree of hybridity
  - Degree of structuration
- **AI-dominated collaboration → Sustained attentional investment → Hybrid problem solving in social entrepreneurship**
- **Human–machine factors**
  - Entrepreneurs' professional knowledge
  - AI explainability
  - Human–machine trust

Figure 6. Research framework of the mechanism by which AI-dominated collaboration affects hybrid problem solving in social entrepreneurship

(1) The mechanism by which AI-dominated collaboration affects hybrid problem solving in social entrepreneurship

The AI-dominated collaboration model adopts a solution-focused strategy; that is, AI independently performs problem definition and solution generation, while humans are responsible for screening and optimizing the results[7]. This helps improve the efficiency of resource utilization and the feasibility of solutions, thereby promoting hybrid problem solving. Its mechanism is manifested in the following three aspects.

First, it enables the generation of innovative solutions. Through latent representational capabilities, AI systems can break through the local-search traps of human cognition and generate "distant innovative solutions." Studies show that AI outperforms purely human solutions in dimensions such as strategic feasibility, financial value, and environmental value[45]. Especially for hybrid problems with a relatively high degree of structuration, AI' s global search capability can expand the solution space and provide solution ideas that exceed entrepreneurs'

cognitive limitations.

Second, it optimizes resource bricolage. In the search stage, AI systems provide systematic solutions and references to best practices by calling on historical case repositories and knowledge graphs. This technological capability complements social entrepreneurs' capacities for mobilizing social capital and informal cooperation networks[14,47]. Such resource complementarity enables social enterprises to better address the challenges of resource scarcity and mission drift.

Finally, it supports value integration and ethical review. In the post-search stage, AI provides objective evaluations based on quantitative indicators, while entrepreneurs make subjective judgments based on professional experience, moral imagination, and empathy[49]. This value-integration mechanism with dual perspectives helps maintain the social mission while preserving economic sustainability, thereby achieving a dynamic balance between the dual goals.

(2) The transmission path of social entrepreneurs' sustained attentional investment

First, in AI-dominated collaboration, AI leads solution generation and releases humans' sustained attention through bottom-up stimulation, thereby reducing cognitive conflict. AI-dominated collaboration gives play to a joint cognitive-extension mechanism, helping social entrepreneurs break through knowledge boundaries, shift attention from short-term problems to long-term strategic goals, and increase sustained attention. In AI-dominated collaboration, AI provides results from deep mining of social information and identification of social opportunities, while social entrepreneurs evaluate and screen these results with implementation-oriented cognition[95]. This bottom-up attentional process can help social entrepreneurs focus on key tasks of long-term strategic significance and avoid attentional dispersion caused by information overload[64].

Second, AI-dominated collaboration enhances the accessibility of hybrid logics by increasing social entrepreneurs' sustained attention, improves resource-use efficiency, and promotes hybrid problem solving. Through global search and the generation of distant innovative solutions, AI reduces social entrepreneurs' cognitive burden, enabling them to concentrate sustained attention on the screening and application of key logics[45]. In this process, the solution-focused strategy plays an important role: social entrepreneurs focus their attention on feasibility assessment and optimized design of solutions, ensuring the deep activation and long-term consistency of logical knowledge[84]. For example, in the allocation of social-entrepreneurial resources, AI provides simulated results for different intervention measures, helping entrepreneurs continuously attend to key decision points of long-term strategic significance. Thus, through the mediating role of sustained attention, hybrid logics can provide optimized support for solving complex problems.

(3) Boundary Conditions for AI-Led Collaboration in Solving Hybrid Problems in Social Entrepreneurship

Following the principles of attention structuring and contextualization[^13], in the process by which AI-led collaboration affects the solving of hybrid problems in social entrepreneurship, there are two key types of moderating variables: one type consists of human–AI factors, which influence the relationship between AI-led collaboration and sustained attention; the other consists of problem types, which directly moderate the relationship between AI-led collaboration and the effectiveness of hybrid problem solving. These two types of moderating effects operate through different mechanisms.

Human–AI factors moderate the impact of AI-led collaboration on sustained attentional investment. According to Sweller' s (1988)[^112] cognitive load theory, the type of cognitive task humans undertake determines the core components of the cognitive load they face, thereby affecting the key bottlenecks in attentional investment. Under an AI-led collaboration model, the core cognitive task for humans shifts to evaluating and screening AI outputs. The cognitive bottleneck no longer stems from the complexity of the task itself, but from whether humans can accurately understand AI-generated content, effectively judge its reasonableness, and possess sufficient willingness to make cognitive investments. Accordingly, the key moderating factors are concentrated at the human–AI cognitive interface, specifically including three dimensions: entrepreneurs' professional knowledge, AI explainability, and human–AI trust. First, entrepreneurs' professional knowledge positively moderates attention allocation through a "knowledge-bridging" mechanism[^113]. When social entrepreneurs possess deep domain knowledge, they can more accurately identify key information points in AI outputs and continuously devote attention to such valuable information. By contrast, entrepreneurs with insufficient professional knowledge find it difficult to filter out key points worthy of attention from the large volume of AI-generated information, leading to dispersed or misdirected attention and making it impossible to form sustained focus. Second, AI explainability positively moderates the level of attention maintenance by reducing extraneous cognitive load. When AI has a high degree of explainability, entrepreneurs can more easily understand the logic behind AI decisions and reduce the cognitive resources required to parse AI outputs, thereby allocating more attentional resources to sustained reflection on key issues. When team members can understand the decision basis of AI outputs, they are better able to maintain sustained attention to the task[^9]. Conversely, black-box AI may cause entrepreneurs to consume excessive cognitive resources in understanding AI outputs, thereby reducing sustained attention to core issues. Third, human–AI trust positively moderates the extent to which attentional resources are openly shared. The level of human–AI trust determines the seriousness and depth of attention with which social entrepreneurs treat AI recommendations[^65,^114]. When the level of human–AI trust is high, entrepreneurs are more willing to consider the information provided by AI in depth and to engage in sustained thinking on that basis; conversely, low trust leads entrepreneurs to process AI outputs only superficially, making it difficult to achieve deep and sustained attentional investment. This trust mechanism is especially critical in

the AI-led collaboration model, because under this model AI is responsible for most problem definition and solution generation, and entrepreneurs must have sufficient trust in AI outputs in order to maintain sustained attention.

Problem type moderates the effect of AI-led collaboration on hybrid problem solving. The two factors of problem hybridity and problem structuring mainly moderate the direct impact of AI-led collaboration on the effectiveness of hybrid problem solving. On the one hand, problem hybridity has a negative moderating effect. Highly hybrid problems usually involve complex value trade-offs and considerations of multiple stakeholders. However, AI has inherent limitations in handling value conflicts and ethical trade-offs, making it difficult for it to fully grasp the socio-commercial hybrid nature of such problems. Under an AI-led collaboration model, solutions independently generated by AI may fail to sufficiently capture the subtleties of this hybridity, resulting in solutions that are less than ideal in balancing social value and commercial sustainability. By contrast, in problems with lower hybridity, the objectives are relatively singular or the boundaries among dimensions are clear, enabling AI to define problem boundaries more precisely and generate effective solutions. On the other hand, problem structuring has a positive moderating effect. Problem structuring moderates collaboration effectiveness by influencing the rationality of human–AI division of labor. In problem contexts with a higher degree of structuring, problems have clear objectives, constraints, and solution paths; this clarity can fully leverage AI' s advantage in systematic search and humans' capacity for goal review, thereby forming a reasonable human–AI division of labor[^115]. In social entrepreneurship contexts, structured problems such as quantitative evaluation of social impact can better match the characteristics of the AI-led collaboration model: the AI system is responsible for systematic data analysis and modeling, while entrepreneurs are responsible for value judgment and ethical review of the results, thereby improving the quality and efficiency of final problem solving.

3.3 Research Content III: Problem Focus: The Hybrid Problem-Solving Mechanism of Human-Led Collaboration

Research Content Three focuses on the human-led collaboration mode and explores its mechanism in solving hybrid problems in social entrepreneurship. It aims to answer the research question: "How does human-led collaboration affect the solution of hybrid problems in social entrepreneurship?" To this end, this part of the study includes three aspects: first, analyzing the mechanism through which human-led collaboration affects the solution of hybrid problems in social entrepreneurship; second, exploring the mediating effect of social entrepreneurs' alternating attention; and finally, examining the moderating effects of human factors (entrepreneurs' cognitive style, affective state, and human–AI cognitive alignment) and problem types (hybridity and degree of structuring). The research framework is shown in Figure 7.

Figure 7. Research framework of the mechanism through which human-led collaboration affects the solution of hybrid problems in

social entrepreneurship

Diagram content:

- **Problem type**
  - Degree of hybridity
  - Degree of structuring

Human-led collaboration → Alternating attention investment → Social entrepreneurship hybrid problem solving

- **Human factors**
  - Entrepreneurial cognitive style
  - Entrepreneurial affective state
  - Human–AI cognitive alignment

(1) The mechanism through which human-led collaboration affects the solution of hybrid problems in social entrepreneurship

The human-led collaboration mode adopts a problem-focused strategy: AI first proposes the representation of a social problem and preliminary solution ideas, and social entrepreneurs then search for solutions based on the problem framework provided by AI[7]. This can improve the speed of problem definition and the adaptability of solutions, effectively balance the demands of multiple stakeholders, and promote the solution of hybrid problems. Its mechanism is manifested in the following three aspects. First, it promotes the collaborative alignment of hybrid goals. In the pre-search stage, AI, through deep data analysis and affective computing capabilities, identifies and quantifies the real needs and potential impacts of beneficiary groups, provides entrepreneurs with predictions that have a stronger evidentiary basis, and helps achieve better alignment between social and economic dual goals. Studies show that AI-assisted problem boundary setting can simultaneously take into account social value and market demand, thereby reducing the risk of mission drift[5]. Second, it optimizes problem structural decomposition. In the search stage, AI can decompose social entrepreneurship hybrid problems into a system of subproblems that can be processed in parallel, helping entrepreneurs more comprehensively grasp the multidimensional attributes of the problem. This structural decomposition and parallel-processing capability enables entrepreneurs to respond more effectively to the challenges of resource scarcity and decision-making complexity faced by social enterprises[116]. Finally, it provides framework-guided cognitive support. The problem-structuring framework provided by AI reduces the cognitive burden on social entrepreneurs during information collection and integration, enabling them to allocate more attentional resources to balancing and implementing hybrid tasks[64].

(2) The transmission pathway of social entrepreneurs' alternating attention investment

First, in human-led collaboration, AI provides a problem framework and optimizes alternating attention investment through top-down guidance, thereby

reducing short-term information-processing load. In a hybrid-goal context, social entrepreneurs' cognitive burden increases substantially. Framework-guided human-led collaboration alleviates cognitive burden and improves alternating attention. In the human-led collaboration mode, AI helps social entrepreneurs construct structured representations of problems through a framework-guided top-down attention process, reducing their cognitive burden and enabling them to devote more attention to the balancing and implementation of hybrid tasks, thereby improving alternating attention[46].

Second, human-led collaboration dynamically balances the demands of multiple stakeholders by improving social entrepreneurs' alternating attention, enhances the availability of hybrid logic (Availability), and promotes hybrid problem solving. The human-led collaboration mode first uses AI systems to conduct preliminary representation and framework-based processing of complex problems, refining the key elements of hybrid logic into a clear structure, thereby enhancing the availability of hybrid logic; that is, when social entrepreneurs

degree to which they master multiple kinds of logical knowledge in the decision-making process. On this basis, social entrepreneurs adopt a problem-focused strategy, concentrating attention on problem identification, priority ranking, and framing, so as to clarify the core contradictions and boundaries of hybrid problems. In this process, entrepreneurs' alternating attentional engagement serves as a mediating variable; by optimizing resource allocation and balancing goals, it promotes the application of hybrid logics in problem solving[^13]. For example, when AI provides key indicators of social impact and economic returns, social entrepreneurs can rely on this framed logical system to rapidly screen and rank decision options, ultimately improving the efficiency and quality of hybrid-problem solving.

(3) Boundary conditions of human-led collaboration for solving hybrid problems in social entrepreneurship

Following the principles of attentional structuring and contextualization[^13], this section considers the moderating roles of human–machine factors and problem types.

Human–machine factors moderate the effect of human-led collaboration on alternating attentional engagement. Drawing on Sweller' s (1988)[^112] cognitive load theory, under a human-led collaboration model, humans' core cognitive task shifts to conducting creative search and multi-objective balancing on the basis of the framework provided by AI. The cognitive bottleneck is no longer concentrated on understanding AI outputs, but rather on whether individuals can, on the basis of a structured framework, carry out flexible and open-ended generative processing and achieve dynamic switching among the demands of diverse stakeholders. This task characteristic requires humans to possess cognitive-processing modes that are compatible with framed information, sufficient cognitive flexibility, and compatibility with AI' s modes of representation. Therefore, the key moderating factors focus on humans' internal cognitive characteristics and states,

specifically including three dimensions: entrepreneurs' cognitive style, emotional state, and human–machine cognitive alignment. First, entrepreneurs' cognitive style positively moderates alternating attentional engagement through the fit between processing modes. Social entrepreneurs with an analytical cognitive style are better at deconstructing and integrating the systematic frameworks provided by AI, and can more effectively concentrate attention on the key dimensions of the problem; by contrast, entrepreneurs with an intuitive cognitive style may feel constrained by the large amount of structured information provided by AI, making it difficult to form efficient alternating attention. Second, a positive emotional state positively moderates attentional quality through the mechanism of cognitive flexibility. Social entrepreneurs' emotional states regulate attentional quality through the mechanism of cognitive flexibility. Positive emotions make it easier for entrepreneurs to integrate AI information and switch flexibly among multiple goals; negative emotions reduce social entrepreneurs' trust in AI and weaken the optimization effect of alternating attention[^106]. Third, human–machine cognitive alignment positively moderates the ability to switch among multiple goals through compatibility in framework understanding. A high degree of cognitive alignment enables social entrepreneurs to accurately grasp the internal logic of the framework constructed by AI, thereby achieving efficient switching among the demands of different stakeholders; a low degree of cognitive alignment, however, is likely to trigger attentional dispersion and cognitive conflict, hindering the smooth progress of multi-objective balancing[^56]. This moderating mechanism is particularly critical in the human-led collaboration model, because in this model AI and entrepreneurs must reach cognitive consensus around the problem framework in order to promote the formation of effective alternating attention.

Problem type moderates the effect of human-led collaboration on hybrid-problem solving. On the one hand, problem hybridity has a positive moderating effect. Problem hybridity moderates the effectiveness of human–machine collaboration by altering the complexity of the problem framework. Highly hybrid problems usually involve more complex trade-offs between social and economic value. In such situations, the preliminary problem framework provided by AI can effectively help entrepreneurs clarify the multidimensional attributes and internal connections of the problem. Compared with problems of low hybridity, the framing role of AI is more prominent in highly hybrid problems and can significantly improve the final quality of problem solving[^1]. Conversely, for problems with relatively low hybridity, the value of AI framing is comparatively limited. On the other hand, problem structuredness has a negative moderating effect. Problem structuredness moderates the collaborative effect by influencing the value of the framework. In unstructured hybrid-problem contexts, the value of AI framing is more pronounced: the preliminary framework it generates can substantially improve the clarity of problem definition, laying a foundation for entrepreneurs' subsequent search for solutions. For unstructured social problems, AI frameworks can help entrepreneurs identify key stakeholders and points of value creation, significantly

improving problem-solving efficiency[^29]. By comparison, in highly structured problems, the marginal value of AI frameworks is relatively small, and the advantages of human-led collaboration are not sufficiently prominent.

3.4 Research Content Four: Problem-Solution Pairing: The Mechanism of Hybrid-Problem Solving in Human-Machine Interactive Collaboration

Research Content Four focuses on the human-machine interactive collaboration model and explores its mechanism of action in solving hybrid problems in social entrepreneurship, aiming to answer the research question: "How does human-machine interactive collaboration affect hybrid-problem solving in social entrepreneurship?"

research question. In response to this question, this part of the study proceeds from three aspects: first, it analyzes the mechanism by which human-AI interactive collaboration affects the solving of hybrid problems in social entrepreneurship; second, it explores the dual mediating effects of social entrepreneurs' attentional investment; and finally, it examines the moderating effects of human-AI factors (depth of AI participation, human-AI trust, and frequency of human-AI interaction) and problem types (hybridity and structuredness). The research framework is shown in Figure 8.

Diagram text in Figure 8

- **Problem type**
  - Degree of hybridity
  - Degree of structuredness
- **Human-AI interactive collaboration**
- **Attentional investment**
  - Alternating attentional investment
  - Sustained attentional investment
- **Solving hybrid problems in social entrepreneurship**
- **Human-AI factors**
  - Depth of AI participation
  - Human-AI trust
  - Frequency of human-AI interaction

Figure 8. Research framework for the mechanism by which human-AI interactive collaboration affects the solving of hybrid problems in social entrepreneurship

(1) The mechanism by which human-AI interactive collaboration affects the solving of hybrid problems in social entrepreneurship

The human-AI interactive collaboration model adopts a problem-solution matching strategy; that is, social entrepreneurs and AI interact continuously during the problem-solving process, continually optimizing problem-solution matching through knowledge integration and dynamic feedback, thereby

improving the novelty and systematicity of solutions and realizing the synergistic creation of social and economic value[38]. Its mechanism is mainly reflected in the following three aspects. First, dynamic calibration of hybrid goals. In the pre-search stage, the AI system provides data support for decision-making by monitoring changes in social needs and resource constraints in real time; social entrepreneurs, in turn, interpret the value of AI outputs based on professional judgment and mission orientation, ensuring the social orientation of decisions[117]. This interactive calibration mechanism helps achieve a dynamic balance between economic and social goals. Second, dynamic balancing of cognitive conflict. In the search stage, the AI system constructs a dynamic value-tradeoff model through multidimensional simulations of stakeholder behavior; entrepreneurs then reprocess AI recommendations based on contextualized cognition and experience, thereby achieving balance among conflicting goals[48]. This continuous, interactive process of cognitive integration significantly improves the quality of solutions to complex problems. Finally, value conflict and ethical judgment. In the post-search stage, fine-grained adjustment of decisions is achieved through multiple rounds of iterative revision. AI provides technical support in breadth and precision, while humans are responsible for deep thinking and ethical judgment[46], forming a problem-solving paradigm that combines breadth and depth.

(2) The dual transmission pathways of social entrepreneurs' attentional investment

Human–AI interactive collaboration activates hybrid logic (Activation) and optimizes hybrid problem solving through dual pathways that influence entrepreneurs' alternating and sustained attentional investment. Specifically, the study is conducted from the following two aspects:

On the one hand, there is the influence pathway and mechanism of human–AI interactive collaboration on alternating attentional investment. The human–AI interactive collaboration model drives the structuring of hybrid goals through the dual orientations of framing and implementation. AI clarifies key performance indicators and their interrelationships through data mining and trend prediction, while social entrepreneurs supplement the tacit value dimensions that AI has difficulty capturing[117]. This "top–bottom integration" attentional process reduces uncertainty in goal clarification and improves the efficiency of alternating attentional investment. On this basis, human–AI interactive collaboration achieves the dynamic balancing of cognitive conflict through the iterative integration of multiple perspectives. AI provides an objective value-tradeoff model, while entrepreneurs reinterpret it based on contextual cognition, thereby finding a balance point among conflicting goals[48]. The enhancement of alternating attention activates hybrid logic, enabling social entrepreneurs to better identify and integrate multiple goals, achieve dynamic matching between problems and solutions, and improve the efficiency and accuracy of hybrid problem solving.

On the other hand, there is the influence pathway and mechanism of human–AI interactive collaboration on sustained attentional investment.

Human–AI interactive collaboration establishes a dynamic feedback integration mechanism, which helps social entrepreneurs manage the high uncertainty of the external environment. Through real-time analysis of multidimensional data sources, AI provides clear feedback, while entrepreneurs make interpretive adjustments based on contextual knowledge, thereby achieving iterative integration of attention[57]. At the same time, through cognitive debiasing and adaptation mechanisms, human–AI interactive collaboration helps entrepreneurs maintain rational focus. Based on objective data analysis, AI corrects cognitive biases that social entrepreneurs may exhibit, such as excessive optimism, thereby ensuring the stability of goal planning[118]. The enhancement of sustained attention deepens the activation of hybrid logics, enabling social entrepreneurs to continuously attend to and balance multiple goals. Through the long-term application of problem–solution pairing strategies, entrepreneurs can maintain continuous tracking of key goals in complex environments, thereby realizing the dynamic optimization of solutions and innovative breakthroughs[7,46].

(3) Boundary conditions of human–AI interactive collaboration in solving hybrid social-entrepreneurship problems

Following the principles of attention structuring and contextualization[13], this part considers the moderating effects of human–AI factors and problem types.

Human–AI factors moderate the influence of human–AI interactive collaboration on attention investment. The human–AI interactive collaboration mode differs essentially from the previous two modes: humans and AI interact continuously at all stages of problem solving, and the cognitive load is no longer borne by a single actor but dynamically circulated and redistributed throughout the interaction process[112]. At this point, the core cognitive task for humans is to maintain cognitive coordination and integration during dynamic interaction; the cognitive bottleneck lies in whether the quality and intensity of the interaction process itself can support sustained cognitive collaboration. On this basis, the moderating factors focus on the structural characteristics of the human–AI interaction process, specifically including three dimensions: depth of AI participation, human–AI trust, and interaction frequency. First, the depth of AI participation has differentiated moderating effects on the two types of attention investment. For alternating attention investment, the depth of AI participation exhibits an inverted U-shaped moderating relationship: overly shallow participation makes it difficult to provide sufficient information exchange to support switching among multiple goals, whereas overly deep participation squeezes the space of human cognitive dominance; neither is conducive to improving alternating attention. For sustained attention investment, however, the depth of AI participation shows a stable positive moderating effect, reflecting the supporting role of deep AI participation in maintaining attention to long-term goals[7]. Second, the level of human–AI trust determines the quality and depth of collaboration. High trust promotes deeper interaction, making entrepreneurs more willing to accept AI's suggestions and engage in in-depth thinking; low trust may lead to a breakdown of collaboration and reduce the effectiveness of attention

investment[65]. This trust mechanism is especially important in the human–AI interactive collaboration mode, because continuous interaction requires both parties to establish a stable relationship of trust. Third, although interaction frequency is conducive to the dynamic adjustment of complex problems, excessively high frequency may increase cognitive load and affect the effect of attention investment[9]. Research shows that an appropriate interaction frequency can maintain the timeliness of information updates while avoiding attentional dispersion caused by excessive interruptions.

Problem type moderates the influence of human–AI interactive collaboration on solving hybrid problems. First, problem hybridity mainly moderates the effectiveness of human–AI collaboration by changing the complexity of the problem space. When a problem involves complex socio-commercial hybrid logics, continuous human–AI interaction can help entrepreneurs better understand and balance different value dimensions, thereby improving the comprehensive effectiveness of solutions. By comparison, for problems with lower hybridity, simple linear collaboration may be more efficient, because the goals are relatively singular or the boundaries of each dimension are clear[29]. Second, the degree of problem structuring moderates the effectiveness of collaboration by influencing the availability of information and the clarity of problem boundaries. In highly structured problems, goals, constraints, and solution paths are relatively clear, and the effectiveness of human–AI interactive collaboration may be limited, because standardized solutions are already sufficient[115]. Conversely, in unstructured problem contexts, the advantages of human–AI interactive collaboration are more pronounced. This is because unstructured problems often lack clear solution frameworks and require continuous human–AI interaction to gradually clarify the problem structure and explore feasible solutions[46].

4 Theoretical Construction

Based on the attention-based view, this study proposes to construct an integrative theoretical framework of "human–AI collaboration–attention investment–hybrid social-entrepreneurship problem solving," deeply analyzing the mechanism through which human–AI collaboration influences the solution of hybrid social-entrepreneurship problems and providing theoretical guidance for the high-quality development of social entrepreneurship. The construction of the theory is mainly reflected in the following four aspects:

First, starting from the hybridity characteristics of the social-entrepreneurship context, this study deeply explores economic logic and social

the characteristics of hybrid problems in contexts where social logics coexist, thereby promoting the further development of social entrepreneurship hybridity theory. Previous studies have mostly focused on the influence of hybridity on organizational institutional logics and structural design[1], while paying less attention to how hybridity specifically operates in the problem-solving processes of social entrepreneurs. This study focuses on the allocation of attentional re-

sources and the cognitive trade-off mechanisms of social entrepreneurs when they face conflicts among hybrid logics. It reveals how the features of hybridity influence the efficiency and effectiveness of problem solving through individual cognition, thereby deepening the theoretical understanding and research connotation of the micro-level cognitive characteristics of hybridity in social entrepreneurship.

Second, this study expands the theoretical connotation of the attention-based view at the level of individual entrepreneurial cognition and advances the cross-level theoretical development of the attention-based view. The traditional attention-based view is mainly grounded at the organizational level, focusing on the relationship between the structural allocation of managerial attention and strategic decision making[84], and has paid less attention to the micro-mechanisms of individual cognitive processing. This study brings the attention-based view down to the level of entrepreneurs' individual cognition. Drawing on the research traditions of vigilance and task switching in cognitive psychology, it deconstructs attentional investment into two operationalizable psychological-cognitive constructs—sustained attention and alternating attention—and clarifies their differentiated functions in balancing hybrid logics. In doing so, it achieves an effective connection between the attention-based view and the micro-level attentional mechanisms of cognitive psychology, enriching its application in the field of entrepreneurial cognition research.

Third, this study reveals the mechanism through which human–AI collaboration affects individuals' attentional control processes, thereby deepening cognitive psychology' s contextualized understanding of attentional control. Previous studies on human–AI collaboration have mostly focused on task division and performance outcomes in human–AI interaction[7], while rarely examining systematically how AI intervention reconstructs individuals' attentional control processes. Based on cognitive load theory and differences among modes of human–AI collaboration, this study systematically explains the internal pathways through which AI reshapes entrepreneurs' attentional perspectives via task allocation and cognitive-load transfer mechanisms: AI-led collaboration forms bottom-up attentional control, human-led collaboration forms top-down attentional control, and interactive human–AI collaboration forms dynamic attentional control that combines both top-down and bottom-up processes. This responds to the core psychological question of how external cognitive support regulates the allocation of individual attentional resources.

Fourth, this study enriches the cognitive-psychological theory of multi-objective hybrid problem solving and extends the theoretical boundaries of problem-solving research. Traditional problem-solving research has mostly focused on information processing and strategy selection in single-objective contexts, while research on cognitive processes under the coexistence of multiple conflicting objectives remains relatively weak[30,31]. This study constructs a cognitive-psychological analytical framework for hybrid problem solving, revealing the stabilizing role of sustained attention in focusing on long-term strategic goals,

the dynamic role of alternating attention in switching among the demands of diverse stakeholders, and the facilitating role of their synergy in integrating hybrid value. It thereby provides a new theoretical perspective and empirical direction for research on cognitive processing in contexts involving conflicting multiple objectives.

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Qiu Zhenyu: proposed the research idea, designed the research plan, drafted the paper, and revised the final version of the paper;

Tao Qin: drafted the paper and designed the experimental plan;

Zhao Chenfang: drafted the paper, constructed the research framework, and revised the final version;

Liu Zhiyang: proposed the research idea, research propositions, and theoretical guidance.

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