The Impact of Problem Specification Structuredness on Crowdsourcing Contexts

Kai YE
Department of Information Systems, Business Statistics and Operations Management
Hong Kong University of Science and Technology
Address: Clearwater Bay,
Kowloon, Hong Kong SAR
Email: kai.ye@connect.ust.hk

Tat Koon KOH *
Department of Information Systems, Business Statistics and Operations Management
Hong Kong University of Science and Technology
Address: Clearwater Bay,
Kowloon, Hong Kong SAR
Email: koh@ust.hk
* *Corresponding author*

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ABSTRACT

This study explores the impacts of the structure of problem specifications in crowdsourcing contests. We theorize that the structure affects seekers' difficulty in initiating contests, influencing the number of contests they launch. It also shapes solvers' participation and idea generation, affecting the number of solvers and the number of high-quality ideas in contests. Using a natural experiment in which a platform increased the structuredness of problem specifications for certain contests, we find that this change led to more contests being launched by seekers. However, even with an increase in contests, individual solvers participated in fewer contests, and those contests attracted fewer solvers. Additionally, although more structured problem specifications helped individual solvers generate more high-quality submissions, there were fewer such submissions in contests. Therefore, more structured problem specifications can be a double-edged sword, making the process easier for seekers but discouraging solver participation and hindering seekers' ability to source exceptional ideas.

Keywords: Crowdsourcing, contests, problem specification, natural experiment, seekers, solvers, idea quality

INTRODUCTION

Crowdsourcing contests allow organizations (i.e., seekers) to solicit ideas and solutions from external, third-party individuals (i.e., solvers) to address their problems [57]. These contests represent a new form of economic activity, shaping the future of work [18]. They also constitute a significant part of the global freelance platform industry, which is projected to grow at a CAGR of over 16% until 2033.[1] Various studies examine how seekers' involvement in contests—such as the exemplars, prizes, and feedback they provide—affects solvers' participation or ideation [22, 29, 33-35, 59]. In this research, we focus on a specific aspect of seeker involvement related to the problem specifications, through which seekers communicate the focal problems and convey their requirements for desired ideas or solutions to solvers [17, 30, 49]. For example, in logo contests, seekers can describe the task (e.g., designing a restaurant logo) and specify what they are looking for in potential ideas (e.g., the logo's look and feel) in the project briefs. These details are crucial in influencing solvers' decisions and strategies when participating in contests. As solvers value winning [9, 33, 63] and expect to perform better on problems that match their expertise [44], they are likely to select contests based on the problem specifications provided. Additionally, given the difficulty in clearly identifying the criteria for idea evaluation [29], solvers can use the problem specifications to infer the types of solutions that align with the seekers' preferences—a critical factor in determining the winning submissions [57]. Thus, problem specifications can significantly influence solvers' behaviors and outcomes in contests.

Although studies have examined problem specification attributes in crowdsourcing contests (e.g., length, informativeness, linguistic cues; see Table 1), the effects of the structure of problem specifications remain an open question. This aspect warrants focused study because seekers generally have autonomy over *what* information they include but not *how* that information is structurally collected and displayed by the platform. We argue that problem specification structuredness is not merely an interface choice but a fundamental mechanism that influences the cognitive activities of seekers and solvers. As this research indicates, this aspect of problem specifications can influence the involvement of seekers and solvers in contests. Since seekers may be unfamiliar with the focal problem and do not launch contests frequently [2, 34], they might be deterred from starting contests when the problem specification structure increases their perceived or actual effort and difficulty in providing information about their requirements. Conversely, they are more likely to launch contests if the structure makes it easier to specify their requirements. For solvers, the problem specification structure can impact their understanding and perceptions of the focal problems, thereby affecting their participation in contests. Moreover, because problem specifications contain critical

[1] https://www.mordorintelligence.com/industry-reports/freelance-platforms-market and https://www.grandviewresearch.com/industry-analysis/freelance-platforms-market-report (accessed: July 2026).

details for idea generation, their structure can affect solvers' submissions in contests. Hence, the problem specification structure plays a non-trivial role in the decisions and behaviors of seekers and solvers.

Table 1. Studies of Problem Specifications in Crowdsourcing Contests

Study	Aspect of Problem Specifications	Seeker-related Outcome	Solver-related Outcome
Yang et al. [62]	Length	-	Number of participating solvers
Erat and Krishnan [17]	Completeness	-	Breadth of solution search by solvers
Jiang et al. [30]	Information type (conceptual objectives and execution guidelines)	-	Number and effort of participating solvers
Koh and Cheung [35]	Exemplars (problem-related and/or problem-unrelated)	-	Number of ideas scanned, shortlisted, and selected by solvers
Yin et al. [64]	Writing strategy (requirement-oriented and reward-oriented)	-	Number of participating solvers
Wu et al. [60]	Linguistic signals (informative and affective)	-	Number of participating solvers
Mo and Zhang [46]	Information type (extent of preference disclosure and latitude of rejection)	-	Number of (new) participating solvers daily
This study	Structuredness	Number of contests seekers launched	Number of participating solvers and high-quality ideas in contests

This research examines the structuredness of problem specifications in crowdsourcing contests. Adapting the conceptualization of structuredness in crowdsourcing data collection settings [40, 41], we define *problem specification structuredness* as the extent to which seekers detail their requirements using predetermined classes presented as data-entry choices to guide their descriptions. In information-related settings, low structuredness supports rich, flexible descriptions but demands significantly more cognitive effort to process and interpret. Conversely, high structuredness standardizes inputs for easier comparison, though it risks restricting expressiveness and losing contextual nuance. Problem specifications on contest platforms can range from less to more structured. Less structured problem specifications enable seekers to express their requirements primarily through open-ended text, with minimal guidelines or restrictions on the details they provide. For example, seekers launching logo contests on DesignCrowd and machine learning contests on Kaggle describe their requirements in text fields.[2] Seekers have significant flexibility in deciding which aspects of the requirements to state and how to describe them [41]. As a result, there can be high variability in the aspects covered in problem specifications, even across contests of the same type [40, 41]. By contrast, seekers follow a predefined configuration to describe their requirements when the problem specifications are more structured. Seekers may be asked to provide predetermined aspects of their

[2] https://www.designcrowd.com/start/ and https://www.kaggle.com/competitions?new=true (accessed: July 2026).

requirements and choose from predefined options to add details. For instance, Crowdspring and Atom guide seekers in articulating their requirements when launching logo contests and company-naming contests, respectively.[3] In this case, the problem details are highly organized, and the aspects covered are more standardized across similar contests.

We examine how the problem specification structure affects seekers when initiating contests, thereby influencing the number of contests launched—an outcome that impacts solvers' earnings and platforms' revenues.[4] We also explore how it shapes solvers' decisions to participate in contests, thereby affecting solver turnout. This is a material outcome as greater solver participation can help seekers harness the wisdom of the crowd and obtain diverse and desirable solutions [37, 43, 57]. Additionally, we consider how the structure affects the number of high-quality ideas. We test our theorizing in a natural experiment involving a change implemented by a design contest platform. Specifically, the platform increased the problem specification structuredness for logo contests, while leaving other contest types (e.g., webpage design) unchanged. We found that increasing the structuredness of problem specifications led to a 17.35% increase in the average number of logo contests launched daily by seekers. Despite more contests being available, solvers participated in fewer contests after the problem specifications became more structured. Consequently, the contests attracted an average of 13.06% fewer solvers. More importantly, although more structured problem specifications helped individual solvers generate more high-quality submissions, they led to a 34.45% drop in the total number of high-quality submissions in contests. A key insight from our double-edged findings is that *simplifying the contest launching process may not always benefit seekers, as it can reduce solver participation and hinder their chances of obtaining exceptional ideas from the crowd.*

This work contributes in several ways. First, our focus on the structure of problem specifications in crowdsourcing contests complements existing studies of problem specification attributes (see Table 1). The findings from this study thus contribute to the literature and deepen our understanding of how problem specifications affect contests. Second, beyond the effect of problem specification structure on solvers, we also examine its influence on seekers, a topic that has received relatively little theoretical attention (see Table 1). Understanding seekers' motivation and involvement is crucial because crowdsourcing contests are inherently multi-sided: seekers need to hold contests to provide opportunities for solvers. Hence, failure to attract and motivate seekers to launch contests will undermine the value propositions and revenue of

[3] https://www.crowdspring.com/start-a-project/ and https://www.atom.com/start-contest?step=2&type=1 (accessed: July 2026).

[4] Designcrowd charges seekers 4% fees for posting projects and solvers a 15% design commission (https://www.designcrowd.com/fees; accessed: July 2026). Crowdspring's fees for seekers in logo contests range from $99 to $474 (https://www.crowdspring.com/pricing/; accessed: July 2026). Thus, platforms earn more when seekers launch more contests.

contest platforms. Third, this research offers insights into the complex dynamics among various contest stakeholders. Seekers and solvers have their own considerations and objectives, and promoting one group's interests can inadvertently affect the other. Our findings suggest that although more structured problem specifications can help seekers launch contests to address their problems, they may also limit seekers' ability to receive good ideas and solutions from solvers. Nonetheless, we identify a way that seekers can mitigate these effects.

RELATED LITERATURE

Seekers play a vital role in the crowdsourcing ecosystem, and their contests directly contribute to earning opportunities for solvers and to the revenue of contest platforms. The characteristics of the seekers' problem can determine whether crowdsourcing is appropriate [2]. For instance, seekers may be more likely to use crowdsourcing for problems that are difficult to solve internally or require diverse perspectives, as these situations emphasize the importance of harnessing external creativity [28, 34, 52]. Additionally, the perceived difficulty of describing the problem can influence their decision to initiate a contest; problems that are seen as too complex or resource-intensive to define may discourage seekers from engaging in crowdsourcing [2]. Another factor influencing seekers' decisions to initiate contests is how easily the final solution can be evaluated. Seekers are more likely to crowdsource when they believe that the solutions generated can be readily assessed for quality and relevance to their needs.

For solvers, participation in contests is influenced by a dual motivational profile comprising both extrinsic and intrinsic elements [7, 9, 16, 50]. Extrinsic motivation arises from factors such as prize amounts, award structures, and accruing winnings [10, 15, 33, 55, 57, 61]. Conversely, intrinsic motivation stems from the satisfaction of completing tasks, the enjoyment of problem-solving, and a passion for community engagement [9, 13, 63]. As solvers navigate the contest ecosystem, they may value open and equal access to opportunities, fair evaluation procedures, and autonomy in choosing their work [14].

Studies also indicate that the form and substance of problem specifications are important considerations for solvers (see Table 1). Yang et al. [62] find that contests with longer descriptions increase switching costs for solvers, leading to lower participation. Wu et al. [60] demonstrate that using concrete, precise, and emotionally positive language can boost solver participation, while Mo and Zhang [46] show that seekers disclosing their preferences can achieve a similar effect. Erat and Krishnan [17] show that providing incomplete information in problem specifications broadens solvers' search scope. Along similar lines, Jiang et al. [30] recommend that seekers disclose all execution guidelines but not all conceptual objectives to promote solver participation and effort. Koh and Cheung [35] find that exemplars provided by seekers in project briefs can negatively affect solvers' ideation outcomes, causing solvers to search, shortlist, and/or submit fewer ideas. Linguistic cues also affect solvers' behavior. Yin et al. [64] analyze requirement-oriented and reward-oriented writing strategies for problem specifications and observe that these strategies impact solver participation differently.

While existing research provides valuable insights into the *content* of problem specifications, such as the specific types of information seekers provide, our study focuses on a complementary aspect: the *structure* of the presentation. For example, Jiang et al. [30] examine the impact of conceptual objectives and execution guidelines within project briefs. By focusing on problem specification structuredness as our primary independent variable and using the information types from Jiang et al. [30] as control variables, our study isolates the effect of the structuredness. (We attempted but could not replicate all the major findings from Jiang et al. [30] using our data; see Appendix A for details.) This approach offers distinct but complementary insights into how platform-driven structural constraints influence contest stakeholders.

THEORY AND HYPOTHESES DEVELOPMENT

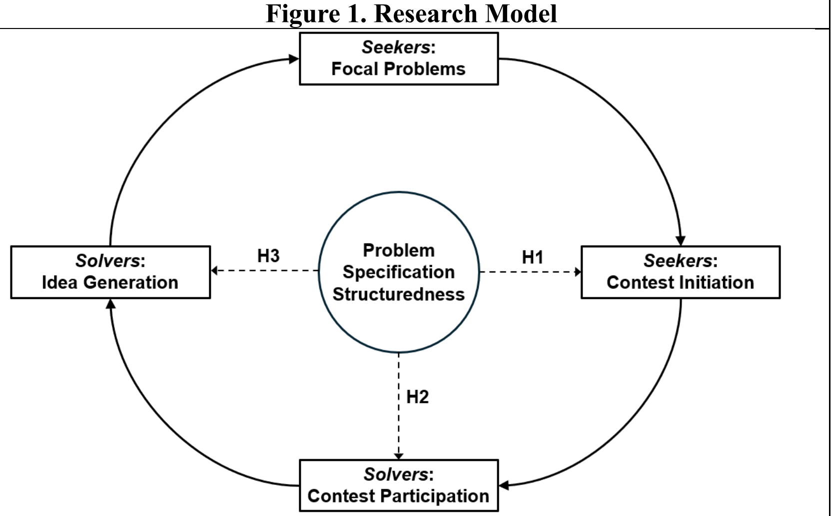
Theoretical Background

Drawing on prior research on distributed cognition [11, 26, 27], we conceptualize crowdsourcing contests as a *distributed cognitive ecosystem* comprising seekers, solvers, and the technological artifacts connecting them. The stakeholders' activities in these contests are inherently *distributed* across time and space; the respective involvements of seekers and solvers are asynchronous, with solvers functioning as external third parties who lack formal organizational ties to the seekers [29, 57]. Moreover, as we theorize below, the key involvements of seekers and solvers unfold across different aspects of the contests. The environment and activities are fundamentally *cognitive*, based on the complementary processes of problem framing by seekers [2, 46] and problem solving by solvers [17, 33, 35]. Additionally, the contests function as an *ecosystem* in which seekers and solvers coexist and interact despite their distinct, sometimes conflicting, incentives and objectives [2, 9, 63]. It is within this conceptualization that the problem specifications in the project briefs play a critical role in coordinating distributed work and bridging asynchronous seekers and solvers.

This study focuses on how the structuredness of problem specifications affects seekers and solvers. Structuredness is a relevant concept for the collection, representation, and processing of information and data. In various IS-related contexts, structuredness refers to the degree to which data is organized, formatted, and constrained by predefined schemas or architectures [1]. For example, in healthcare, patient information can range from highly unstructured free-text clinical notes to highly structured electronic health records that require practitioners to use standardized dropdown menus and specific diagnostic codes [54, 56]. Similarly, in user-generated content, such as citizen science platforms and online review systems, data ranges from open-ended text descriptions to strict, predefined classification choices and rating scales [40, 41]. Across these diverse settings, studies typically operationalize structuredness by the extent of constraints, guidance, and predefined classes imposed on users during data entry. The implications of using low versus high structuredness are significant. Low structuredness accommodates rich, flexible, and highly detailed descriptions, but it increases the cognitive load and effort required for others to process, compare, and interpret the resulting information. Conversely, high structuredness generally enhances data comparability, reduces processing ambiguity, and standardizes inputs for easier aggregation and analysis. However, it can also restrict user expressiveness, force unnatural categorizations, and lead to the loss of nuanced, contextual information.

In the context of crowdsourcing contests, the structuredness of problem specifications varies across platforms. Typically, less structured problem specifications offer seekers an open-ended format, giving them maximum flexibility to state their requirements with few restrictions on the details they provide. Conversely, more structured problem specifications guide seekers to address specific aspects of their requirements using closed-ended formats (e.g., predefined data-entry options). In the following section, we theorize how the structuredness of problem specifications influences the cognitive activities of key stakeholders throughout the contest lifecycle, from seekers' initial creation of the problem representation to solvers' interaction with it during contest selection and idea generation. Figure 1 presents our research model.

Figure 1. Research Model



Hypotheses Development

Seekers' Cognitive Activity – Creating the Problem Representation

The first critical step in coordinating the contest ecosystem is for the seekers to create an external representation of their problems. The problem specifications in project briefs detail seekers' project requirements and preferences for desired solutions [49]. Poorly framed problem specifications or those with incomplete or vague information can lead to misinterpretations [2, 47] and result in solutions that do not satisfy the requirements [5]. Whereas prior studies such as Erat and Krishnan [17] and Jiang et al. [30] examine how the amount or types of information provided by seekers affect outcomes (see Table 1), this present research focuses on the *structure* of the representational medium itself. Although seekers must properly detail their problem specifications, depending on how they are asked to provide the information, transforming their internal mental state of the problem into a coherent, tangible problem representation is cognitively demanding. Seekers are often inexperienced with crowdsourcing contests; they may lack sufficient knowledge of the focal problems (especially those that are infrequent or non-recurring) or the relevant expertise [2]. For example, seekers hosting logo contests might not have design knowledge and thus may not know which design features are pertinent to specify or how to describe them in the problem specifications. As a seeker remarked in the problem specification for their logo contest, *"I have no experience requesting design efforts, so I am unsure how to describe my preferences."*[5]

As the cognitive difficulty of describing problems can deter seekers from engaging in crowdsourcing [2], we posit that less structured problem specifications, such as those that mainly use open-ended questions, require more cognitive effort from seekers and discourage some from starting contests. Without guidance, seekers may not know or provide all the relevant information solvers need about their requirements [41]. By contrast, more structured problem specifications (e.g., using multiple-choice questions or sliders to indicate what they seek in predetermined solution attributes) can serve as scaffolding, helping seekers with the contest initialization process. This reduces the prerequisite knowledge that seekers—especially those who lack experience with their focal problems or using contests—need to create their problem representation and the overall perceived complexity of launching contests. Thus, we expect fewer (more) seekers to launch contests when the contest platforms implement less (more) structured problem specifications.

H1: The number of contests is lower (higher) when the problem specifications are less (more) structured.

Solvers' Cognitive Activity – Contest Selection

Once the problem representation is created, the cognitive work shifts to the solvers. Driven by extrinsic motivation (e.g., winning) [7, 9, 50] and intrinsic motivation (e.g., task autonomy) [15, 33, 55, 57, 61], solvers self-select the contests they want to participate in [28, 38, 44, 45, 51, 55, 65]. To this end, the problem specifications of the respective contests help solvers compare and choose which contests to join [49]. With this in mind, we argue that the problem specification structure can influence solvers' participation by affecting their perceived income uncertainty and task autonomy. First, solvers likely have a target income from participating in contests; although this target may vary due to factors like outside options and expenses, it should not be influenced by how the problems are presented in contests. Given their limited resources and the winner-take-all outcomes in contests, solvers will need to compare ongoing contests to identify those where they are more likely to win, so they can achieve their income target. When the problem specifications are less structured, there can be considerable variation in what is covered across contests [40,

[5] https://99designs.com/logo-design/contests/rebranding-consulting-firm-60058/brief (accessed: July 2026).

41]. This lack of uniformity across problem representations creates cognitive frictions, making it harder for solvers to (i) analyze and compare the seekers' requirements and (ii) identify those in which they are likely to have better winning prospects. This raises their perceived income uncertainty and encourages them to enter more contests to improve their chances of reaching their income target. By contrast, more structured problem specifications standardize the representational state, making it easier for solvers to identify contests where their winning prospects are more favorable and thereby reducing their perceived income uncertainty. They may thus choose to compete in fewer contests to achieve their income target. (This resembles the income-targeting behavior in the gig economy, where workers become less likely to work after reaching their income target [3, 24]. While previous studies focus on gig workers' labor supply in response to actual earnings, we theorize how solvers' labor supply responds to perceived earning uncertainty caused by the structuredness of problem specifications.)

Second, the problem specification structure can affect solvers' perception of task autonomy, or the extent to which they have freedom and control over how the contest tasks will be solved [32]. Task autonomy is a critical factor in solver participation [9, 63] and can be affected by task modularity and the level of detail in the requirements [14]. When problem specifications are presented in a less structured manner in contests, the representation is perceived as malleable; solvers may view seekers' requirements as more open to interpretation, giving them a greater say in the idea generation process. This increased perceived task autonomy can encourage more solvers to join contests. By contrast, contests with more structured problem specifications can give the impression that solvers must work within the highly specified requirements. This can reduce perceived task autonomy, causing some solvers to self-select out of such contests.

In short, since we expect the structuredness of the problem specifications to shape solvers' perceptions of income uncertainty and task autonomy, we posit that less (more) structured problem specifications lead individual solvers to participate in more (fewer) contests. Therefore, at the contest level, all else being equal, the total number of solvers in contests is higher (lower) with less (more) structured problem specifications.

> *H2: The number of participating solvers in contests is higher (lower) when the problem specifications are less (more) structured.*

Solvers' Cognitive Activity – Idea Generation

Seekers' ultimate goal in contests is to gather outstanding ideas for their needs [21]. From their perspective, high-quality ideas are those that address their core problems, fulfill their stated requirements, and match their tastes and preferences [34, 57]. We submit that the problem specification structure influences the number of high-quality submissions—evaluated by the seekers—in contests by affecting solvers' participation and idea generation. On the one hand, the number of participating solvers and the number of high-quality submissions should be positively correlated; according to the *"parallel path effect"* [8], having more solvers expands the solution search approaches, which can lead to more high-quality submissions. Thus, if more structured problem specifications cause contests to attract fewer solvers (H2), they could also limit the diversity of cognitive approaches at the aggregated contest level, resulting in fewer high-quality ideas. On the other hand, such problem specifications can have a positive *"ideation effect"* on individual solvers. Clearer, more organized problem specifications help solvers better understand the scope and requirements of the contests, enabling them to develop solutions that more closely align with the seekers' needs and preferences. This can lead to more high-quality submissions.

Given opposing parallel path and ideation effects, the overall impact of problem specification structuredness on high-quality submissions depends on which effect is stronger. Suppose a contest attracts n solvers, each of whom submits j high-quality submissions on average; the total number of high-quality submissions will be nj. If the number of participating solvers is reduced by a proportion of p ($0 < p < 1$), each remaining solver must submit q proportionally more high-quality submissions for the total to remain the same in the contest. Formally, $nj = n(1 - p)j(1 + q)$. Simplifying and rearranging, $q = p/(1 - p) > p$. Thus, a decrease in solver quantity requires a more than proportional increase in the number of high-quality submissions per solver to maintain the total. In fact, as the decline in participating solvers rises (e.g., from 10% to 20%), the necessary increase in the corresponding number of high-quality submissions per solver to keep the total stable becomes even greater (e.g., from 11% to 25%). However, generating high-quality submissions is challenging; for example, Gross [22] reported that only 5.13% of submissions in logo design contests received the highest 5-star ratings from seekers, indicating that it is not easy to produce outstanding ideas (as perceived by seekers). Moreover, due to cognitive limits and rigidity in problem-solving and solution search [20, 48, 58], individual solvers may be able to increase the number of high-quality submissions only up to a certain point. This suggests that the increase in high-quality submissions per solver may be bounded and inadequate to offset a decline in participating solvers, especially if the decrease is significant. As such, we expect the parallel path effect to generally outweigh the ideation effect, and the number of high-quality submissions to be higher (lower) in contests with less (more) structured problem specifications.

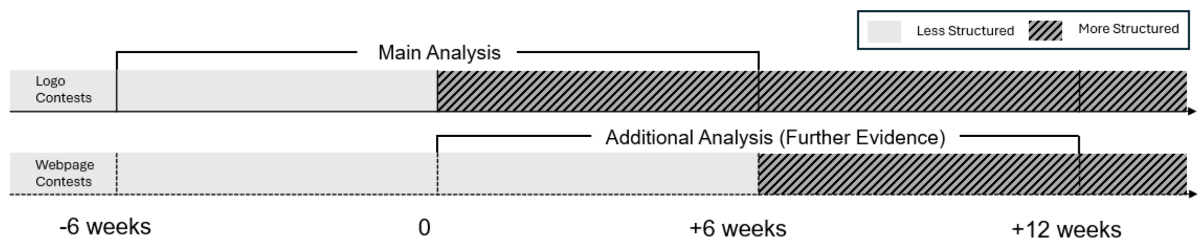
> *H3: The number of high-quality submissions in contests is higher (lower) when the problem specifications are less (more) structured.*

DATA AND METHOD

Empirical Context

The empirical setting for this research is 99designs, a crowdsourcing contest platform for creative graphic designs. Seekers can initiate contests (e.g., logo, webpage, banner ads) on 99designs by formulating the problem specifications and setting the winning prizes. Solvers then join the contests and submit their ideas or solutions. At the end of the contests, the seekers select the submissions they want, and the prizes are awarded to the winning solvers.

Figure 2. Timeline of Changes Implemented by the Platform



The platform changed the problem specification structure of webpage contests 6 weeks after changing that of logo contests. Although both logo and webpage contests became more structured, the structuredness differs; please refer to Figure 3 and Appendix F.

An exogenous change occurred on January 25, 2011, when 99designs modified the problem specification structure for logo contests; the structure for other contest types (e.g., webpage contests) did not change until at least 6 weeks later (see Figure 2). Figure 3 shows the stylized problem specification structure for logo contests before and after this change. Overall, the problem specifications became more structured. Before the change, they consisted of four sections (e.g., Background Information, Contest Details) and eight subfields (e.g., Description of the Organization and Its Target Audience, Requirements). Seekers had to describe their requirements and expectations for solvers' submissions, which could be wordy and inconsistent across contests; see Appendix B (Figure B1) for an example. This might have made it relatively difficult for seekers to articulate their requirements and for solvers to compare contests. After the change, the problem specifications had 15 subfields; a key difference was that the "Content Details" section was replaced by the "Visual Style" section, which had more subfields. The platform also made it easier for seekers to specify their preferences using multiple-choice questions, indicate style attributes with sliders (integer values between -5 and 5), and describe the logo's use cases and color preferences; see Appendix B (Figure B2) for an example. This change should help solvers better compare requirements across different logo contests.

Figure 3. Problem Specification Structure for Logo Contests

Before Format Change

Background Information
- Company Name [text]
- Overview [text]
- Description of the Organization and Its Target Audience [text]

Content Details
- Requirements [text]

References
- Attachments [file upload]

Contest Deliverables
- Final Files
  - Layered Vectors [choice set]
  - Screen Quality [choice set]
  - Fonts [text]

After Format Change

Background Information
- Name to Incorporate in the Logo [text]
- Slogan to Incorporate in the Logo [text]
- Description of the Organization and Its Target Audience [text]
- Industry [text]

Visual Style
- Logo Types [choice set]
- Logo to Be Used [choice set]
- Color Preferences [text]
- Other Color Requirements [text]
- Style Attributes [rating scale]
- Design Inspiration [text]

References
- Attachments [file upload]
- Other Notes [text]

Contest Deliverables
- Final Files
  - Layered Vectors [choice set]
  - Screen Quality [choice set]
  - Fonts [text]

Note: (1) After the structure change, some seekers used the "Other Notes" section to indicate additional design requirements (e.g., fonts, shapes, and more style attributes) that were not covered by the "Visual Style" section. Before the change, such details were indicated in the "Requirements" section. (2) Input type for each field is in the square brackets.

We assessed the informativeness of the problem specifications both before and after the structure change. As Appendix C reports, the proportions of contests in which seekers provided details of their organization, industry, the slogan to incorporate, the types of logos they desired, logo usage, and preferred colors did not differ significantly before and after the change. However, although a large proportion of seekers (M = 0.89, SD = 0.31) already specified their visual attribute requirements before the change, a larger proportion (M = 0.95, SD = 0.21) did so afterward ($Diff$ = 0.06, $p < 0.001$). This likely resulted from the "Visual Style" section being part of the project brief that seekers had to complete after the change.[6] Overall, the informativeness of the problem specifications remained broadly similar across structures.

[6] After the structure change, there were eight visual attributes under "Style Attributes": (1) Classic/Modern, (2) Mature/Youthful, (3) Feminine/Masculine, (4) Playful/Sophisticated, (5) Economical/Luxurious, (6) Loud/Quiet, (7) Simple/Complex, and (8) Subtle/Obvious. Seekers indicated their preference for each attribute using a slider (see Figure B2 in Appendix B). We consider the visual attribute requirements unspecified if the sliders for all visual attributes were in the middle (i.e., the seekers were indifferent for all the attributes). Of the 1,932 contests launched after the structure change, 92 (4.76%) contests had no specified visual attributes.

Data and Variables

The data included 3,588 contests (3,219 logo and 369 webpage contests) conducted 6 weeks before and after the platform adopted more structured problem specifications for logo contests. Our choice of a symmetrical 6-week pre- and post-treatment window was motivated by both empirical constraints and methodological rigor. First, the platform made a similar structure change to our control group (webpage contests) exactly 6 weeks after the change for logo contests. Extending the observation window beyond 6 weeks would thus contaminate the control group. Second, using a symmetric 6-week window helped establish a reasonable baseline of seeker and solver behaviors while reducing the risk of introducing unobserved confounding trends or platform seasonality. Third, since the contests lasted only a few days, the 6-week post-treatment period was long enough to capture stabilized, adjusted behaviors of both seekers and solvers, ensuring that our observations reflected a steady-state shift rather than a temporary change due to initial unfamiliarity.

Table 2. Description of Variables and Summary Statistics

Panel A: Seeker Side (Industry-Day Level)

Variables	Description	Mean	SD
Contest Quantity	Number of contests per industry each day	1.85	1.39
Structured	1 for after problem specification structure change, 0 for before change	0.58	0.49
Logo	1 for logo contests, 0 for webpage contests	0.83	0.37

Panel B: Solver Side (Contest Level)

Variables	Description	Mean	SD
Solver Quantity	Number of participants in the focal contest	27.56	33.08
Quality-Idea Quantity	Number of 5-star submissions in focal contest	3.13	6.50
Structured	1 for after the change in problem specification structure, 0 for before the change	0.60	0.49
Logo	1 for logo contest, 0 for webpage contest	0.90	0.30
Prize	Prize amount in focal contest	283.68	164.23
Guaranteed	1 if focal contest guaranteed prize, 0 otherwise	0.42	0.49
Blind	1 if focal contest allowed solvers to see others' submissions; 0 otherwise	0.17	0.38
Multi Winner	1 if focal contest had multiple winners; 0 otherwise	0.02	0.13
Contest Quantity	Number of competing contests starting on the same date as the focal contest	40.35	17.25
Seeker Experience	Number of contests launched by seekers prior to the focal period	0.08	0.49
Execution Guidelines	The number of execution guidelines mentioned by seekers in each problem specification	4.88	3.51
Conceptual Objectives	The number of conceptual objectives mentioned by seekers in each problem specification	4.70	2.98

We collected information about the seekers, contest attributes (prize amount, prize guarantee, number of winners, solution visibility, etc.), and solvers along with their submissions. Table 2 shows the variables used in this study, and Appendix D presents the correlation matrices. The independent variable is the problem specification structure of the contests (i.e., whether it was more or less structured). For the dependent variables, we operationalized *Contest Quantity* and *Solver Quantity* based on the number of contests initiated by seekers each day and the number of solvers participating in each contest, respectively. We measured *Quality-Idea Quantity* by counting the number of high-quality submissions (as rated by seekers) in each contest. As seekers could rate submissions from one to five stars (or leave them unrated), those receiving a 5-star rating were classified as high-quality; this is similar to the operationalization of idea quality in previous crowdsourcing contest studies [22, 23].

Table 3 shows the distribution of ratings for submissions in our data. Submissions with a 5-star accounted for 5.11% of all rated submissions but 56.83% of the winning submissions; these figures are similar to those in Gross [22], where the top-rated 5-star logo designs represented only 5.13% of all rated entries but 49.60% of the winning designs.[7] The disproportionate number of winning ideas rated 5-star in empirical settings underscores the importance of the quantity of high-quality ideas for seekers in contests.

Table 3. Rating Distribution (Rated Submissions Only)

	1-Star	2-Star	3-Star	4-Star	5-Star	Total
Among rated submissions^						
Count	49,174	54,880	57,239	30,019	10,305	201,617
Percent	24.39	27.22	28.39	14.89	5.11	100
Among winning submissions						
Count	10	24	161	683	1,156	2,034
Percent	0.49	1.18	7.92	33.58	56.83	100
^ 52.3% of submissions in our data were rated by seekers, comparable to the 57.5% of logo designs rated in Gross' (2017) sample.						

We accounted for various factors that could impact the outcomes. When appropriate, we controlled for relevant contest attributes, such as the prize (*Prize*) and whether it was guaranteed (*Guaranteed*), whether solvers were restricted from seeing others' designs during the contests (*Blind*), and whether the contests had multiple winners (*Multi Winner*) [6, 29, 33]. We considered the number of contests that seekers had launched on the platform (*Seeker Experience*), as their experience could affect their reactions to the change. We used the number of contests with the same start date (*Contest Quantity*) to account for concurrent contests [45]. In addition, although the informativeness of the project briefs was largely similar before and after the structure change (Appendix C), we followed Jiang et al. [30] to account for different information provided by seekers in the problem specifications: execution guidelines and conceptual objectives. The former conveys seekers' instructions for design details (e.g., colors, fonts, and shapes), while the latter refers to the look and feel that seekers want in the designs (e.g., professionalism and friendliness). Two coders independently reviewed each problem specification and identified terms related to execution

[7] Of the 4,294 contests in Gross (2017) data, 1,300 contests were not awarded or had winning designs not rated by seekers. Hence, the 1,485 contests with 5-star winning ideas represented 1,485/(4,294-1,300) = 49.60% of contests with rated winning designs.

guidelines (e.g., "red," "sans-serif," etc.) or conceptual objectives (e.g., "modern," "simple," etc.). They then counted the terms for the respective information type in the problem specifications. The interrater reliability, measured by weighted Cohen's Kappa, is 0.90 and 0.91 for the number of execution guidelines and conceptual objectives, respectively, indicating strong agreement between the coders. We measured the execution guidelines and conceptual objectives for each problem specification by averaging the number of terms for each information type across the two coders.

Econometric Specification

Our identification strategy relied on the exogenous change in the problem specification structure. First, the platform did not announce the change in advance. Thus, seekers and solvers could not have anticipated the new structure. Second, since formulating problem specifications was necessary for seekers to launch contests and solvers had to refer to them when entering contests and designing solutions, both parties should have been aware of the change.

As the structure change applied only to logo contests in our data, we used these contests as the treated group. For the control group, we selected webpage contests on 99designs because the problem specification structure for these contests remained unchanged throughout the focal period (i.e., 6 weeks before and after the structure change for logo contests). Also, webpage contests were the second-largest category on 99designs by contest count, after logo contests. Using contests from the same platform for both the treated and control groups minimized unobserved platform-dependent factors. We estimated the causal effects of the problem specification structure using the following difference-in-differences (DID) models, with Equation 1 for testing H1, and Equation 2 for H2 and H3.

$$Q_{it} = \beta_1 Logo_i + \beta_2 Logo_i \cdot Structured_t + \theta_i + \mu_t + \varepsilon_{it} \quad \text{[Equation 1]}$$

$$P_{jt} = \beta_1 Logo_j + \beta_2 Logo_j \cdot Structured_t + \gamma X_{jt} + \theta_i + \mu_t + \varepsilon_{jt} \quad \text{[Equation 2]}$$

where Q_{it} is contest quantity in industry i period t, and P_{jt} is the number of solvers and number of high-quality ideas in contest j period t. $Logo_i$ is 1 (0) for logo (webpage) contests, $Structured_t$ is 1 (0) for after (before) the structure change, θ_i is the industry fixed effect, and μ_t is the week fixed effect. In Equation 2, X_{jt} are control variables.

RESULTS

Main Results

As our dependent variables were nonnegative integers and based on the likelihood ratio test of overdispersion, we used negative binomial regression for the *Solver Quantity* model and Poisson regression for the *Contest Quantity* and *Quality-Idea Quantity* models. Table 4 shows the main results. In Model 1, the positive *Logo* x *Structured* indicates there were more logo contests per industry per day when the problem specifications were more structured, supporting H1. The negative *Logo x Structured* in Models 2 and 3 implies contests with more structured problem specifications had fewer participating solvers and fewer high-quality ideas, respectively. Hence, H2 and H3 are also supported. According to the estimates, after the structure change, the daily number of logo contests in each industry increased by 17.35%, while the number of solvers and high-quality ideas in contests decreased by 13.06% and 34.45%, respectively.[8]

Table 4. Impacts of Problem Specification Structure

	Model 1	**Model 2**	**Model 3**
DV:	**Contest Quantity**	**Solver Quantity**	**Quality-Idea Quantity**
Logo x Structured	0.16* (0.06)	-0.14* (0.07)	-0.49*** (0.07)
Logo	0.63*** (0.05)	2.09*** (0.07)	0.92*** (0.08)
Prize		0.00*** (0.00)	0.00*** (0.00)
Guaranteed		0.43*** (0.02)	0.67*** (0.02)
Blind		-0.39*** (0.03)	-0.24*** (0.03)
Multi Winner		-0.08 (0.08)	0.68*** (0.52)
Seeker Experience		0.08*** (0.02)	-0.00 (0.00)
Execution Guidelines		0.00 (0.00)	0.02*** (0.01)
Conceptual Objectives		0.00 (0.00)	-0.00 (0.00)
Contest Quantity		-0.00*** (0.00)	-0.00*** (0.00)
Solver Quantity			0.00*** (0.00)
Industry fixed effect	Yes	Yes	Yes
Week fixed effect	Yes	Yes	Yes
Observations	1,937	3,588	3,588
Pseudo R^2	0.39	0.17	0.10
Regression	Poisson	Negative Binomial	Poisson

Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*

Robustness Checks

We conducted several tests to confirm the robustness of our main findings. First, we analyzed pre-treatment trends to verify the robustness of our DID analyses. Second, we conducted a subsample analysis to examine the impact of the structure change on new seekers. Third, we checked the results using different regression models and specifications. Fourth, we used an alternative measure of problem specification structuredness and examined only contests in the pre-treatment period to address concerns that the structure change might introduce confounding factors. Fifth, we applied matching techniques to mitigate the risk that information provided by seekers could be a potential confounder. Sixth, we examined solver behavior in blind contests to alleviate concerns that more structured problem specifications enabled solvers to recognize when existing submissions matched their intended solutions, thereby influencing their participation.

Pre-treatment trends. We followed Liu and Bharadwaj [39] and evaluated the effects of structure change in an event study framework by setting the treatment time to zero and comparing the logo and webpage contests before and after this period. Specifically, we estimated the following equations:

[8] Based on the coefficient for *Logo x Structured* in Models 1 to 3, the daily logo contests across industries increased (exp(0.16) – 1) * 100% = 17.35%, the number of participating solvers reduced (1 – exp(-0.14)) * 100% = 13.06%, and number of high-quality ideas reduced (1 – exp(-0.49)) * 100% = 38.74% after the structure change.

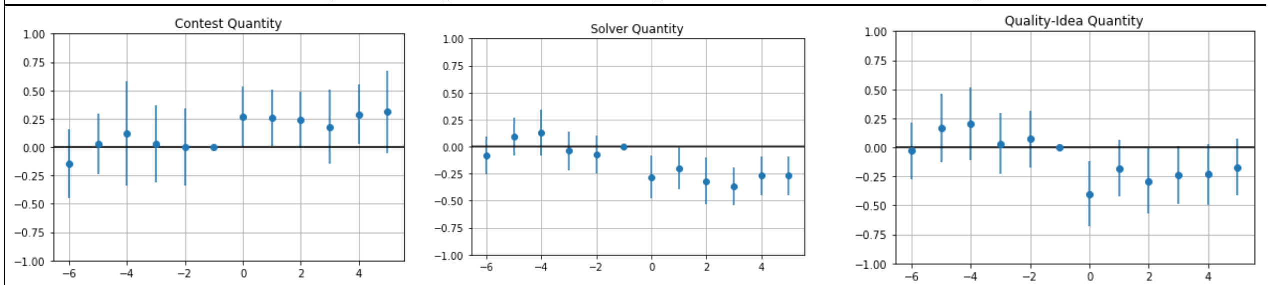
$$Q_{it} = \sum_h \beta_h Logo_i Week_h + \theta_i + \varepsilon_{it} \quad \text{[Equation 3]}$$

$$P_{jt} = \sum_h \beta_h Logo_i Week_h + \gamma X_{jt} + \theta_i + \varepsilon_{jt} \quad \text{[Equation 4]}$$

where Q_{it} is contest quantity in industry i period t, and P_{jt} is the number of solvers and high-quality ideas in contest j in period t. $Logo_i$ is 1 (0) for logo (webpage) contests $Week_h = 1$ if contest i was launched h weeks after the treatment (or launched -h weeks before the treatment if $h < 0$). β_h is the difference between the treatment and control contests in period h compared to the last pretreatment period (h = -1). In Equation 3, θ_i is the industry fixed effect. In Equation 4, X_{jt} are control variables.

Figure 4 shows the coefficients and their 95% confidence intervals for the dependent variables. We did not find significant systematic differences between logo and webpage contests for the dependent variables before the change in problem specification structure. These findings support the parallel trend assumption in our DID analyses and reinforce our main conclusions.

Figure 4. Impacts of Problem Specification Structure Change



Subsample Analysis. As shown in Table 5, most seekers launching contests during the focal period did so for the first time (i.e., no prior contests on 99designs). We argue in H1 that more (less) structured problem specifications make it easier (more difficult) for seekers lacking contest experience to formulate problems, thereby affecting the number of contests they initiate. To test this, we examined the number of first-time seekers before and after the structure change. We conducted a DID analysis on the daily contests using Equation 1 but restricted the data to contests by first-time seekers only. Table 6 shows the results. The positive *Logo x Structured* implies that the number of first-time seekers increased after the problem specifications became more structured, supporting our theorizing.

Table 5. Contests and Seekers Statistics

	Logo Contests			Webpage Contests		
	Before	After	Change (%)	Before	After	Change (%)
Total Contests	1287	1932	50.12	153	216	41.17
Total Seekers	1241	1873	50.92	145	203	40.00
First-time Seekers	1152	1781	54.60	125	178	42.40

Table 6. Impact on First-Time Seekers

	Model 1
DV:	**Contests Quantity (First-Time Seekers Only)**
Logo x Structured	0.18** (0.06)
Logo	0.62*** (0.05)
Industry fixed effect	Yes
Week fixed effect	Yes
Observations	1,853
Pseudo R2	0.38
Regression	Poisson
Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*	

Alternative model specifications. We used OLS regressions with fixed effects to test the robustness of our main findings. Table 7 shows the results. In Model 1, *Logo x Structured* is positive, indicating more logo contests per day after the problem specifications became more structured. In Models 2 and 3, the negative *Logo x Structured* implies contests with more structured problem specifications had fewer solvers and high-quality ideas. These results support all the hypotheses.

Table 7. Impacts of Problem Specification Structure: OLS Regression

	Model 1	Model 2	Model 3
DV:	**Contest Quantity**	**Solver Quantity**	**Quality-Idea Quantity**
Logo x Structured	0.36** (0.11)	-7.13* (3.25)	-1.22* (0.59)
Logo	0.97*** (0.09)	65.83*** (3.37)	2.21** (0.84)
Prize		0.12*** (0.00)	0.00** (0.00)
Guaranteed		12.50*** (0.98)	1.86*** (0.22)
Blind		-11.65*** (1.44)	-0.55 (0.34)
Multi Winner		-1.81 (3.86)	3.68* (1.68)
Seeker Experience		3.47*** (0.93)	0.01 (0.20)
Execution Guidelines		0.24 (0.14)	0.06 (0.04)
Conceptual Objectives		0.14 (0.16)	0.00 (0.03)
Contest Quantity		-0.08 (0.05)	-0.01 (0.01)
Solver Quantity			0.03*** (0.01)
Industry fixed effect	Yes	Yes	Yes
Week fixed effect	Yes	Yes	Yes
Observations	1,937	3,588	3,588
R^2	0.12	0.27	0.09
Regression	OLS	OLS	OLS
Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*			

Table 3 shows that 9 out of 10 winning submissions received at least 4 stars. We thus used the number of 4- or 5-star submissions as an alternative measure of *Quality-Idea Quantity*. In Table 8, the negative *Logo x Structured* is consistent with our main result.

Table 8. Alternative Measure of Quality-Idea Quantity

	Model 1
DV:	**Quality-Idea Quantity (4-5 Star)**
Logo x Structured	-0.39*** (0.04)
Logo	0.70*** (0.04)
Prize	0.00*** (0.00)
Guaranteed	0.63*** (0.01)
Blind	-0.20*** (0.01)
Multi Winner	0.67*** (0.03)
Seeker Experience	0.09*** (0.01)
Execution Guidelines	0.02*** (0.00)
Conceptual Objectives	0.00 (0.00)
Contest Quantity	-0.00* (0.00)
Solver Quantity	0.00*** (0.00)
Industry fixed effect	Yes
Week fixed effect	Yes
Observations	3,588
Pseudo R^2	0.172
Regression	Poisson
Robust standard errors in parentheses. * $p < .05$ ** $p < .01$ *** $p < .001$	

Pre-treatment period contests. It is possible that using a slider after the structure change could affect the information input modality and, consequently, the solvers' decisions to enter contests or their ideation outcomes. To address this, we examined only contests during the pre-treatment period. The problem specifications for these contests were all in text format, but the details were presented in different ways. Some lacked any structure (Figure E1 in Appendix E), some organized the information very systematically (e.g., by color, fonts, feel, etc.) (Figure E2 in Appendix E), and others showed some but not all details in a structured way (Figure E3 in Appendix E). One of the authors and a research assistant independently classified the problem specifications of the pre-treatment contests as low, mid, or high based on how well the information was structured. The Cohen's Kappa of their classification was 0.89, indicating strong interrater agreement. We then averaged their classifications to measure how structured the problem specification was in each contest (*Structuredness*); the score ranged from 0 to 1, with higher scores indicating a more structured presentation (M = 0.11, SD = 0.26).

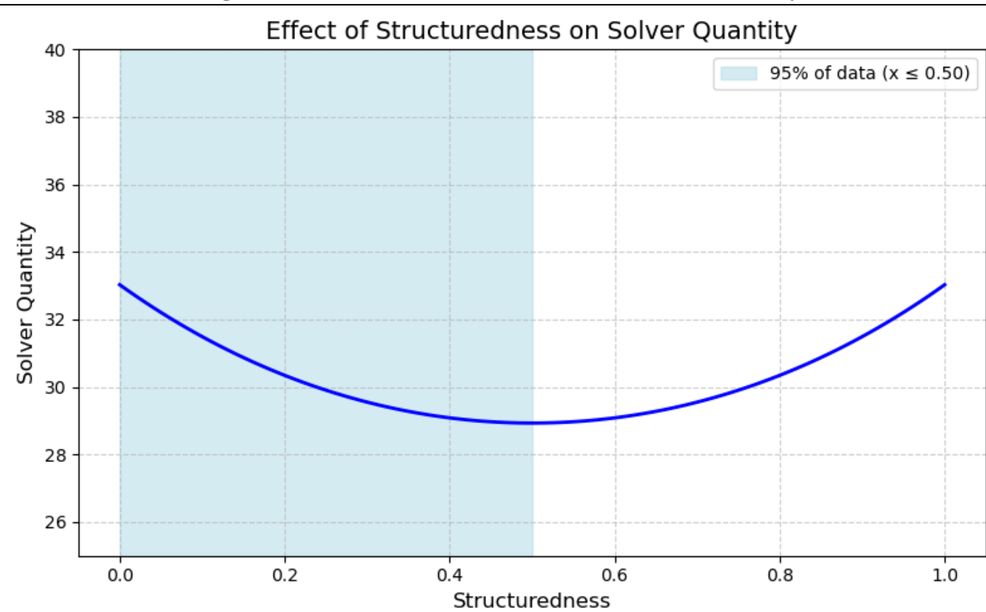
We analyzed the effects of *Structuredness* on *Solver Quantity* and *Quality-Idea Quantity* for pre-treatment contests. Table 9 presents the results. In Model 1, *Structuredness* had a negative impact on the number of solvers; generally, contests with more structured problem presentations attracted fewer solvers. In Model 2, we included the quadratic term *Structuredness*^{2} to assess a non-linear effect. *Structuredness* remains negative, and *Structuredness*^{2} is positive, indicating a U-shaped relationship between *Structuredness* and *Solver Quantity* (Figure 5). About 95% of our data is at or below *Structuredness* = 0.50, where the relationship between *Structuredness* and *Solver Quantity* is negative. These findings support H2.

Table 9. Impacts of Problem Specification Structure in Pre-treatment Period

	Model 1	Model 2	Model 3	Model 4
DV:	**Solver Quantity**	**Solver Quantity**	**Quality-Idea Quantity**	**Quality-Idea Quantity**
Structuredness	-0.12* (0.06)	-0.53** (0.18)	-0.06 (0.06)	-0.47* (0.20)
Structuredness^2		0.53* (0.21)		0.50* (0.24)
Prize	0.01*** (0.00)	0.01*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
Guaranteed	0.36*** (0.03)	0.36*** (0.03)	0.56*** (0.03)	0.56*** (0.03)
Blind	-0.46*** (0.04)	-0.46*** (0.04)	-0.48*** (0.05)	-0.49*** (0.05)
Multi Winner	-0.02 (0.12)	-0.01 (0.11)	0.55*** (0.08)	0.55*** (0.08)
Seeker Experience	-0.04 (0.05)	-0.05 (0.06)	-0.25*** (0.07)	-0.28*** (0.07)
Execution Guidance	0.00 (0.00)	0.00 (0.00)	0.00 (0.01)	0.00 (0.01)
Conceptual Objectives	0.01** (0.00)	0.01* (0.00)	0.00 (0.00)	0.00 (0.00)
Contest Quantity	-0.01*** (0.00)	-0.01*** (0.00)	-0.01** (0.00)	-0.01** (0.00)
Solver Quantity			0.00 (0.00)	0.00* (0.00)
Industry fixed effect	Yes	Yes	Yes	Yes
Week fixed effect	Yes	Yes	Yes	Yes
Observations	1,287	1,287	1,287	1,287
Pseudo R^2	0.64	0.64	0.09	0.09
Regression	Negative Binomial	Negative Binomial	Poisson	Poisson

Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*

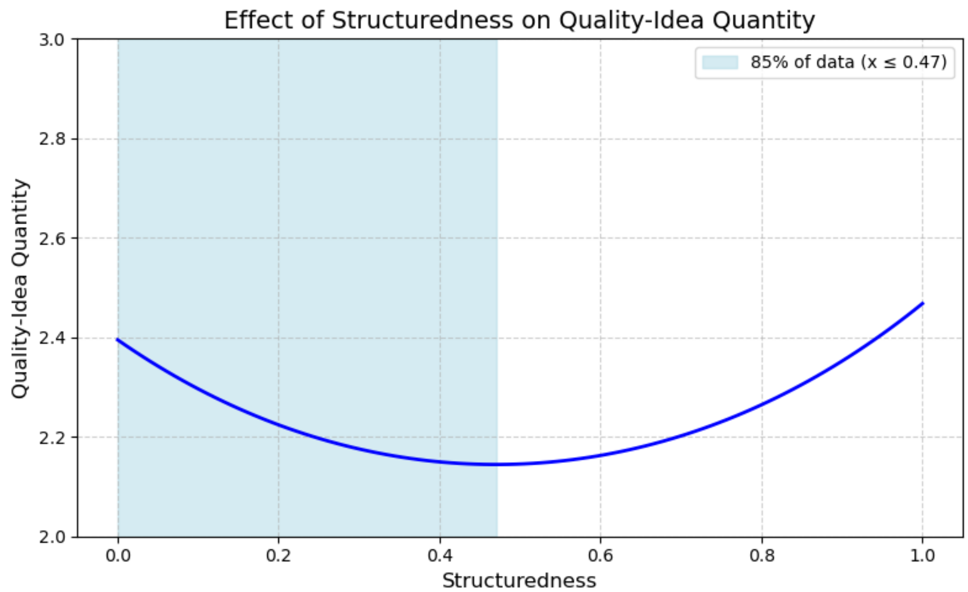
Figure 5. Effect of Structuredness on Solver Quantity



Approximately 95% of the contests in our data (1,218 out of 1,287) are at or below Structuredness = 0.50, where the relationship between *Structuredness* and *Solver Quantity* is negative.

We observed a similar effect of *Structuredness* on *Quality-Idea Quantity*. In Model 3, *Structuredness* is negative, albeit not significant. In Model 4, the negative *Structuredness* and the positive *Structuredness*^{2} suggest a U-shaped relationship between *Structuredness* and *Quality-Idea Quantity* (Figure 6). The marginal effect of *Structuredness* is negative when it is 0.47 or less, which accounts for about 85% of the observations in our data. Thus, the empirical results largely support H3.

Figure 6. Effect of Structuredness on Quality-Idea Quantity



Approximately 85% of the contests in our data (1,079 out of 1,287) are at or below Structuredness = 0.47, where the relationship between Structuredness and Quality-Idea Quantity is negative.

Matching. There is concern that more structured problem specifications could have reduced participation due to changes in task complexity, detail, etc. To address this, we matched the logo contests before and after the change in problem specification structure based on *Execution Guidance* and *Conceptual Objectives*. The number of requirements stated by seekers should correlate with the complexity and detailedness of the focal contests. We conducted 1:1 nearest-neighbor propensity score matching without replacement and identified 667 pairs of logo contests before and after the change. In the matched sample, the differences between contests before and after the change in terms of *Execution Guidance* (M_{before} = 5.54, SD_{before}= 2.89, M_{after} = 5.54, SD_{after}= 2.89, *diff* = 0.00, t = 0.00, p = 1.00) and *Conceptual Objectives* (M_{before} = 3.94, SD_{before}= 2.23, M_{after} = 3.94, SD_{after}= 2.23, *diff* = 0.00, t = 0.00, p = 1.00) are not significant. Table 10 presents the regression results of the matched sample. The negative *Structured* in Models 1 and 2 indicates that there were fewer solvers and fewer high-quality ideas in contests with more structured problem specifications.

Table 10. Impacts of Problem Specification Structure: Contest Level Matched Sample

	Model 1	**Model 2**
DV:	**Solver Quantity**	**Quality-Idea Quantity**
Structured	-0.21** (0.08)	-0.18** (0.07)
Prize	0.01*** (0.00)	0.00*** (0.00)
Guaranteed	0.44*** (0.03)	0.63*** (0.03)
Blind	-0.51*** (0.07)	-0.64*** (0.05)
Multi Winner	-0.25* (0.12)	0.69** (0.08)
Seeker Experience	0.12* (0.06)	0.11** (0.04)
Execution Guidelines	0.01 (0.01)	0.01* (0.04)
Conceptual Objectives	0.00 (0.01)	0.05*** (0.01)
Contest Quantity	0.01 (0.00)	-0.01 (0.00)
Solver Quantity		0.00 (0.00)
Industry fixed effect	Yes	Yes
Week fixed effect	Yes	Yes
Observations	1,334	1,334
Pseudo R^2	0.59	0.10
Regression	Negative Binomial	Poisson

Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*

Blind contests. One concern is that highly structured problem specifications might have allowed solvers to more quickly recognize existing submissions that closely aligned with their intended solutions. In such cases, solvers' decisions to abstain from participating could be a rational response to diminished marginal returns (i.e., a lower chance of winning against similar, already-submitted ideas), rather than a lack of motivation. However, this would not be an issue in contests in which solvers could not see competing solvers' submissions. We thus conducted analyses focusing exclusively on blind contests, where solvers could not observe the competition during the contests. Table 11 presents the results of the contest-level analyses. The negative *Logo x Structured* in Models 1 and 2, respectively, suggests that blind contests with more structured problem specifications had fewer solvers and fewer high-quality ideas, supporting H2 and H3.

Table 11. Impacts of Problem Specification Structure: Blind Contests

	Model 1	**Model 2**
DV:	**Solver Quantity**	**Quality-Idea Quantity**
Logo x Structured	-0.22* (0.10)	-0.29** (0.10)
Logo	1.27*** (0.12)	0.72*** (0.11)
Prize	0.00*** (0.00)	0.00*** (0.00)
Guaranteed	0.41*** (0.05)	0.69*** (0.48)
Multi Winner	0.26 (0.17)	0.70*** (0.10)
Seeker Experience	0.03 (0.03)	-0.00 (0.00)
Execution Guidelines	0.02** (0.01)	0.05*** (0.00)
Conceptual Objectives	0.01 (0.01)	0.00 (0.00)
Contest Quantity	-0.01** (0.00)	-0.01** (0.00)
Solver Quantity		0.00*** (0.00)
Industry fixed effect	Yes	Yes
Week fixed effect	Yes	Yes
Observations	747	747
Pseudo R^2	0.07	0.14
Regression	Negative Binomial	Poisson

Robust standard errors in parentheses. * p < .05 ** p < .01 *** p < .001

Additional Analyses

We conducted a series of analyses to unpack the underlying mechanisms for the observed outcomes. First, we performed seeker analyses to rule out concerns that the structure change triggered other changes that might have confounded our results. Second, we conducted solver analyses to test our theorization regarding perceived task autonomy and income uncertainty. Third, we examined how seekers could strategically deploy other contest features to mitigate these negative effects. Fourth, we examined the effects of problem specification structure in webpage contests to further support our main findings. Together, these mechanism-relevant findings highlight how problem specification structuredness operates as a double-edged sword across the distributed cognitive ecosystem.

Seeker analyses. Prizes [33] and information [30] provided by seekers can shape solvers' participation and idea generation. Thus, there is concern that the change in the problem specification structure might also have affected other factors, such as the prize amount and the informativeness of the problem specifications, which could influence solver participation. We examined how the structure change affected the contest prize, execution guidelines, and conceptual objectives. We used OLS because the dependent variables are continuous. In Table 12, *Logo* x *Structured* is not significant across all models, suggesting that the structure change did not affect the prize amount or the informativeness of the problem specifications.

Table 12. Impact on Contest Prize and Informativeness

	Model 1	**Model 2**	**Model 3**
DV:	**Prize**	**Execution Guidelines**	**Conceptual Objectives**
Logo x Structured	1.51 (29.84)	0.16 (0.32)	0.66 (0.38)
Logo	-379.51*** (22.51)	2.78*** (0.34)	1.46*** (0.37)
Prize		0.00* (0.00)	0.00** (0.00)
Guaranteed	13.06** (3.99)	0.37** (0.12)	0.20 (0.10)
Blind	51.32*** (6.78)	-0.21 (0.17)	-0.20 (0.17)
Multi Winner	75.92 (40.55)	0.09 (0.55)	0.44 (0.52)
Seeker Experience	-18.76*** (4.43)	0.08 (0.10)	-0.02 (0.09)
Execution Guidelines	0.98* (0.47)		
Conceptual Objectives	1.95** (0.67)		
Contest Quantity	0.11 (0.12)	0.00 (0.01)	-0.01 (0.00)
Industry fixed effect	Yes	Yes	Yes
Week fixed effect	Yes	Yes	Yes
Observations	3,588	3,588	3,588
R2	0.55	0.08	0.05
Regression	OLS	OLS	OLS
Robust standard errors in parentheses. * p < .05 ** p < .01 *** p < .001			

An alternative explanation is that the change in the problem specification structure might have affected seekers' evaluation behaviors and ratings, leading to fewer highly rated ideas. Specifically, the problem specification structure could have impacted seekers' ease of evaluation (affecting the proportion of ideas rated) and their evaluation standards (affecting the number of 5-star ratings given). We thus examined seekers' ratings before and after the structure change. As Table 13 shows, the proportion of rated ideas remained largely similar before and after the change ($Z = 0.77$, $p = 0.44$). Also, the cumulative distribution functions of rated ideas (CDF) for both periods are nearly identical, and the Kolmogorov-Smirnov (K-S) statistic (0.02) is not significant (p = 0.97). These results indicate that the structure change did not significantly alter the ease and standard of seekers' evaluations.

Table 13. Rating Distribution

	Less Structured		**More Structured**		
Rating	**Proportion (%)**	**CDF (%)**	**Proportion (%)**	**CDF (%)**	**Abs. Diff. in CDF (%)**
Unrated	46.95	46.95	48.34	48.34	1.39
1 star	13.43	60.38	12.18	60.52	0.14
2 star	14.62	75.00	13.92	74.44	0.56
3 star	14.83	89.83	14.86	89.30	0.53
4 star	7.51	97.34	8.02	97.34	0.02
5 star	2.66	100.00	2.68	100.00	0.00

Solver analyses. For H2, we argue that more structured problem specifications lower solvers' perceived income uncertainty, which reduces the contests they join. However, an alternative argument is that lower perceived income uncertainty can motivate solvers to join more contests to boost their income. To explore this, we examined the number of contests each solver joined during the pre- and post-treatment periods. We operationalized the dependent variable, *Contests Participated*, as the number of contests solvers joined each week. Table 14 shows the results. In Model 1, the negative *Logo x Structured* suggests that more structured problem specifications led solvers to join fewer contests, despite there being more contests after the change. This supports our income-targeting theorizing, which holds that solvers enter fewer contests when they can more effectively compare and evaluate their options.

Table 14. Effect of Problem Specification Structure on Contest Participation

	Model 1
DV:	**Contests Participated**
Logo x Structured	-0.09** (0.03)
Logo	0.68*** (0.05)
Week fixed effect	Yes
Solver fixed effect	Yes
Observations	40,264
Pseudo R2	0.58
Regression	Negative Binomial

Robust standard errors in parentheses. * p < .05 ** p < .01 *** p < .001

Next, we examined how solvers' efficacy moderated the impact of problem specification structure. The literature shows that the importance of task autonomy can depend on individuals' efficacy (i.e., their ability to organize and execute the necessary actions to achieve specific goals) [4]. According to Langfred and Moye [36], those with higher efficacy are more likely to prefer discretion in their tasks and believe they can perform better with task autonomy than those with lower efficacy. Also, solvers may be better at evaluating winning prospects as their efficacy increases. Thus, the impact of problem specification structuredness on solvers' perceived income uncertainty should be more pronounced for high-efficacy solvers. If our argument about solvers' perceived income uncertainty and task autonomy is correct, high-efficacy solvers should have participated in fewer contests than low-efficacy solvers after the structure change.

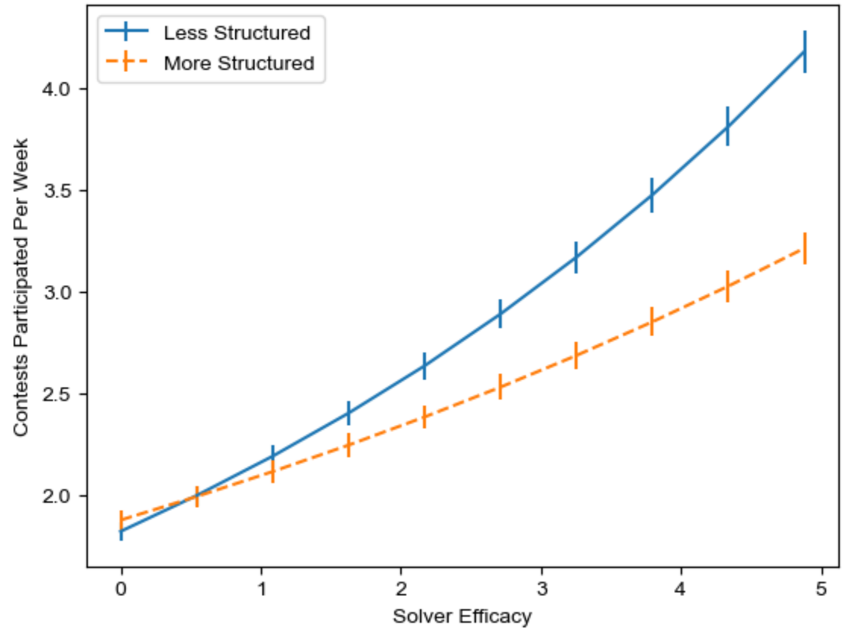
Since individuals' accomplishments and experiences are influential sources of efficacy information [4, 36], we measured *Solver Efficacy* by the number of prior contests won by the respective solvers. This is a reasonable proxy because solvers with higher efficacy were likely better at navigating competition and completing tasks in contests, leading to better contest performance [12, 25, 42, 65]. We excluded solvers who did not participate in any contests before the focal period and log-transformed the number of prior contests won to reduce skewness. Table 15 presents the results of the DDD analysis. In Model 1, the negative three-way interaction *Logo x Structured x Solver Efficacy* implies that, following the change, solvers with higher efficacy competed in fewer logo contests than those with lower efficacy. This is illustrated in Figure 7 and supports our underlying arguments for H2. In Model 2, we used the proportion of contests won by a solver as an alternative measure for *Solver Efficacy*. The results again show a negative *Logo x Structured x Solver Efficacy* interaction.

Table 15. Moderating Effects of Solver Efficacy on Impacts of Problem Specification Structure

	Model 1	**Model 2**
DV:	**Contests Participated**	**Contests Participated**
Logo x Structured x Solver Efficacy	-0.08** (0.03)	-0.09*** (0.02)
Logo x Structured	0.03 (0.03)	0.06 (0.03)
Logo x Solver Efficacy	0.08*** (0.02)	0.07*** (0.01)
Structured x Solver Efficacy	0.02 (0.03)	0.01 (0.02)
Logo	0.60*** (0.03)	0.64*** (0.02)
Solver Efficacy	0.09*** (0.02)	0.03** (0.01)
Week fixed effect	Yes	Yes
Solver fixed effect	Yes	Yes
Observations	32,509	32,509
Pseudo R^2	0.60	0.60
Regression	Negative Binomial	Negative Binomial

Solver Efficacy is operationalized using log(number of prior contests won + 1) in Model 1 and log(percentage of contests won +1) in Model 2.
Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*

Figure 7. Solver Efficacy and Problem Specification Structure for Logo Contests



The graph uses the incidence rate ratio of the coefficients for the predictor variables. Solver Efficacy is based on the number of contests won by the respective solvers before the focal period. Compared with less structured problem specifications, more structured ones led solvers to compete in fewer logo contests per week, and the impact was stronger for solvers with higher efficacy.

Up to this point, the solver analyses focus on their contest participation decisions regarding the number of contests they enter. It is also necessary to consider whether the problem specification structure affected solvers' effort in the contests they chose to join. We thus examined the impact on the quantity of solvers' ideas, which is an essential consideration in contests [19, 35, 59]. The results are shown in Table 16; we used OLS because the dependent variables are continuous. Model 1 examines the effect of problem specification structure on solvers' effort in the contests they entered. *Logo x Structured* is nonsignificant, indicating that the problem specification structure did not affect the number of ideas submitted by solvers. Models 2 and 3 explore the moderation effect of solver efficacy. The nonsignificant *Logo x Structured x Solver Efficacy* interaction in these models suggests that solver efficacy did not alter the impact of problem specification structure. Considering these findings alongside the main results, we conclude that the problem specification structure shaped the solvers' decisions to participate in contests but did not affect their participation effort.

Table 16. Impacts of Problem Specification Structure on Solver Effort

	Model 1	Model 2	Model 3
DV:	**Idea Quantity Per Contest**	**Idea Quantity Per Contest**	**Idea Quantity Per Contest**
Logo x Structured x Solver Efficacy		-0.15 (0.14)	-0.08 (0.11)
Logo x Structured	-0.36 (0.22)	-0.33 (0.18)	-0.33 (0.19)
Logo x Solver Efficacy		0.32 (0.43)	1.02* (0.52)
Structured x Solver Efficacy		0.22 (0.14)	0.05 (0.10)
Logo	0.57 (0.30)	0.58** (0.21)	0.13 (0.25)
Solver Efficacy		-0.28 (0.47)	-0.38 (0.29)
Week fixed effect	Yes	Yes	Yes
Solver fixed effect	Yes	Yes	Yes
Observations	40,264	32,509	32,509
R^2	0.51	0.32	0.32
Regression	OLS	OLS	OLS

Solver Efficacy is operationalized using (1) log(number of prior contests won + 1) in Models 2 and (2) log(percentage of contests won +1) in Models 3.
Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*

In H3, we argue that more structured problem specifications help solvers develop ideas that better match seekers' requirements, leading them to produce more high-quality ideas individually (ideation effect). To test this, we examined how the structure of problem specifications affected the number of high-quality ideas generated by solvers. Table 17 shows the results. In Model 1, the positive *Logo x Structured* indicates that solvers produced 17.35% more high-quality ideas in contests with more structured problem specifications, supporting our theorization.

Table 17. Impacts of Problem Specification Structure on High Quality Ideas

	Model 1
DV:	**Quality-Idea Quantity per Solver**
Logo x Structured	0.16* (0.07)
Logo	-0.33*** (0.05)
Contests Participated	0.02*** (0.00)
Week fixed effect	Yes
Solver fixed effect	Yes
Observations	40,264
R^2	0.43
Regression	Poisson

Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*

Improving quality-idea quantity in contests with more structured problem specifications. More structured problem specifications can lead to fewer high-quality ideas (H3), so it is critical to consider how seekers can address this in contests that adopt such specifications. As having more solvers can increase the scope of parallel exploration and idea diversity, thereby raising the likelihood of extreme outcomes (such as highly rated ideas) [8, 31, 45, 57, 66], we posit that seekers hosting contests with more structured problem specifications should improve the attractiveness of their contest prizes. This tactic of strengthening extrinsic incentives can be particularly critical for attracting solvers [33], given the negative impact that more structured problem specifications may have on the intrinsic aspects (i.e., task autonomy) of contests.

Table 18 presents the impact of contest prizes. In Model 1, the negative *Logo x Structured* indicates that more structured problem specifications decreased the number of participating solvers. However, the positive *Logo x Structured x Prize* suggests higher prizes could mitigate this effect, as we posited above. In our data, *ceteris paribus*, a ten-dollar increase in prize money attracted 4.10% more solvers to participate.[9] In Model 2, *Solver Quantity* had a positive effect on idea quality. Thus, having more solvers in contests contributed to more high-quality ideas.

Table 18. Improving Quality-Idea Quantity

	Model 1	**Model 2**
DV:	**Solver Quantity**	**Quality-Idea Quantity**
Logo x Structured x Prize	0.004*** (0.000)	0.00 (0.00)
Logo x Structured	-1.16*** (0.08)	-0.90*** (0.09)
Logo	1.65*** (0.07)	0.87*** (0.07)
Prize	0.00*** (0.00)	0.00*** (0.00)
Guaranteed	0.42*** (0.02)	0.67*** (0.02)
Blind	-0.36*** (0.03)	-0.26*** (0.03)
Multi Winner	0.03 (0.07)	0.74*** (0.05)
Seeker Experience	0.08*** (0.02)	0.00 (0.02)
Execution Guidelines	0.00 (0.00)	0.02*** (0.00)
Conceptual Objectives	0.01** (0.00)	0.00 (0.00)
Contest Quantity	-0.00*** (0.00)	-0.00** (0.00)
Solver Quantity		0.003*** (0.000)
Industry fixed effect	Yes	Yes
Week fixed effect	Yes	Yes
Observations	3,588	3,588
Pseudo R^2	0.11	0.10
Regression	Negative Binomial	Poisson

Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*

Further evidence from webpage contest structure change. As shown in Figure 2, immediately after our focal period (i.e., 6 weeks following the structure change for logo contests), the platform changed the problem specification structure for webpage contests. Appendix F displays the stylized structures of webpage contests before and after the change. Specifically, the problem specifications increased from four sections and 11 subfields to five sections and 12 subfields. We analyzed the impact of the problem specification structure for webpage contests using DID with logo contests as the control group. The focal period is 6 weeks before and after the change; the structure of the logo contests remained unchanged. We present the details in Appendix F and highlight the key findings here. The impact of more structured problem specifications on the number of webpage contests launched was positive, as H1 suggests, but not significant; the number of webpage contests increased by only 3.05% after the change. This may be because the structure change for webpage contests was relatively minor, and its impact on seekers was thus less pronounced than that for the logo contests in our main analysis. For example, the new problem specification

[9] Based on the coefficient for *Logo x Structured x Prize* in Model 1, the number of solvers increases by a factor of exp(0.004) = 1.0040 for every dollar increase in prize amount. Thus, every ten-dollar increase in contest prize is associated with ((1.0040^10) - 1) * 100% = 4.10% increase in solver quantity.

structure for webpage contests still required substantial text input from seekers, whereas that for logo contests involved more multiple-choice questions and sliders. We found a negative impact of the structure change on the number of solvers in contests. Specifically, our estimates indicate that 17.30% fewer solvers participated in webpage contests with more structured problem specifications, supporting H2. While more structured problem specifications had a negative effect on the number of 5-star ideas in contests, the impact was not statistically significant. However, there was a significant 13.93% decrease in 4- and 5-star ideas in contests. There is thus some evidence supporting H3.

Next, we examined solver-level behaviors and outcomes. Solvers participated in significantly fewer webpage contests when the problem specifications became more structured. Specifically, they joined 12.19% fewer webpage contests after the change. In addition, solvers generated 33.64% more high-quality ideas with more structured problem specifications. These findings support our arguments regarding the impact of the structure of problem specifications.

DISCUSSION

This study explores how the dynamics among seekers and solvers in crowdsourcing contests are affected by the structure of the problem specifications. An insight from our results is that the problem specification structure can be a double-edged sword. Compared to less structured problem specifications, more structured ones increase the likelihood that seekers will launch contests but can also discourage solvers from participating and reduce the number of high-quality submissions. We attribute these outcomes to cognitive and motivational mechanisms among the stakeholders in the ecosystem. For seekers, more structured problem specifications serve as cognitive scaffolding, reducing the effort needed to articulate their needs and initiate contests. For solvers, however, this structure standardizes how problems are represented, decreases income uncertainty, and limits their sense of task autonomy. This encourages self-selection and restricts the parallel search paths crucial for idea generation. An important implication is that the problem specification structure influences both seekers and solvers in contests, and these effects can be positive and negative at the same time. Hence, future research should develop theories on how contest features impact seekers *and* solvers to fully understand their effects. For example, earlier studies look at how certain contest features influence solvers, such as contest prizes [33] and feedback [29, 34, 53, 59]. However, increasing contest prizes or providing feedback also requires seekers to dedicate more resources and effort, which can impact their motivation to launch contests and, in turn, influence solvers' behavior.

Our study complements and broadens the literature on problem specifications by shifting the theoretical focus from informational content to information structure. Prior crowdsourcing research has examined how the content of problem specifications (e.g., length, affective linguistic signals, and specific types of information disclosed; see Table 1) affects solvers. By focusing on the structuredness of problem specifications, our study shows that the presentation of the problem influences solvers even when the underlying informational content remains broadly similar. A critical implication of this distinction is that crowdsourcing dynamics are not solely driven by seekers' communication strategies; rather, they can be constrained and directed by the platforms' interface design. Future theoretical frameworks should thus evaluate platform-mandated structural affordances as drivers of distributed cognitive work, rather than merely treating them as neutral conduits for information exchange between seekers and solvers.

By examining how the structuredness of problem specifications influences both parallel search and ideation effects, this study offers insights into the complexity of having more solvers and ideas, which previous research shows is crucial for seekers [21, 35, 37, 43, 57]. Specifically, we show that for a given decrease in the number of participating solvers, the average number of high-quality ideas submitted by solvers must increase more than proportionally to maintain the total number of good ideas in contests. However, this can be challenging, as solvers may lack the capacity to generate significantly more high-quality ideas. A theoretical implication is that multiple dynamics influence the generation and acquisition of high-quality ideas in contests. More importantly, we need to recognize that these dynamics may not operate in isolation and should thus consider how they interact to affect contest outcomes.

Idea quality is crucial for seekers in crowdsourcing contests, as their main goal is to acquire high-quality solutions from the crowd. A key finding of this study is that contests with more structured problem specifications are likely to receive fewer high-quality ideas. Although the current situation is that seekers have little control over the structure, as contest platforms determine it, there may be tactics they can use to increase the number of high-quality ideas. Our analyses show that seekers can offer higher contest prizes to attract more solvers and increase the number of quality ideas. This indicates a trade-off between the seekers' cognitive and financial costs when using contests. Given what we know about how seekers' problem specifications affect solvers' participation and involvement, future studies can explore other approaches (e.g., non-monetary incentives) for seekers to shape solvers' decisions and strategies.

Our results show some consistent effects of structuredness on the quality of work performed by the crowd. Specifically, we find that more structured problem specifications lead to fewer high-quality ideas in crowdsourcing contests, whereas [40, 41] show that a structured interface decreases the quality (accuracy and completeness) of submissions from individuals in crowdsourcing data collection. It is important to note, though, that the mechanisms differ: in our case, the parallel path effect dominates the ideation effect, whereas in [40, 41] the mechanisms were information loss and errors arising from a lack of data-entry flexibility. Nonetheless, given that the types of crowds (graphic designers vs. general public) and tasks (idea generation vs. data reporting) differ across the studies, the impact of structuredness on work quality is, to some extent, generalizable across different crowds and projects. At the same time, unlike [40, 41], this study also examines upstream effects by analyzing seekers' participation, thus providing a more holistic picture of the impacts of structuredness in crowdsourcing. Interestingly, we find that the structure aiding seekers in problem representation limits solvers' participation and ideation outcomes. These distinct effects of structuredness on seekers and solvers that we show in this study may inform future research. Specifically, users' roles (e.g., information contributors or consumers) may act as a boundary condition that affects the effect of structuredness.

This research offers practical implications for contest platforms. First, for new platforms aiming to attract new seekers, more structured problem specifications may be more effective, as it will be easier for such seekers to launch contests. For more established platforms, they should strategically choose the problem specification structure given seeker heterogeneity. We note that platforms typically use a single version of the problem specification form for seekers to complete when launching contests; although different forms may exist for various contest types (e.g., logo and webpage contests have separate problem specification forms), these forms are usually identical within each contest type. However, based on our results, platforms could consider implementing different problem specification forms even within the same contest type. Specifically, they can offer new seekers a more structured form to help them specify their requirements, and experienced seekers a less structured form to increase solver participation. This approach can address the needs of different seekers. Second, platforms should consider solver heterogeneity when deciding on the structure of the problem specifications. In our case, high-efficacy solvers participated less when the problem specifications were more structured, which can be problematic. Thus, platforms must account for how the impacts of problem specification structures can vary across solvers.

Limitations and Future Studies

As in most research, we are mindful of the generalizability of our findings. Our empirical setting is design contests, which may have specific, unique considerations. New studies can examine the structuredness of problem specifications in other types of contests (e.g., coding) to better inform theory and practice. Due to data constraints, our analyses also encountered certain limitations. Our study implicitly suggests that having more solvers and ideas in contests is usually better for seekers, but it can also increase their evaluation costs. However, our data does not allow us to examine the cost-benefit trade-offs. In addition, because we rely on archival platform data, we cannot directly observe the underlying psychological mechanisms, such as seekers' cognitive effort and solvers' perceived income uncertainty and task autonomy. While we infer these mechanisms from observable behavioral outcomes, experimental and survey studies can directly measure these constructs and validate the underlying psychological processes.

We suggest important directions for future work. First, new research can build on our argument that the decline in high-quality ideas in contests with more structured problem specifications stems from reduced parallel search paths, an effect that outweighs improvements in bounded individual-level idea generation (H3). It is possible that the structuredness of problem specifications shapes solvers' cognitive style and problem-solving approach (e.g., exploration vs. exploitation), thereby affecting the boundaries of their ideation. Examining this can provide further insights into the impact of problem specification structures in contests.

Second, changes in structuredness may affect how seekers process and evaluate ideas. Although the problem specification structures may not affect the ease and standard of seekers' idea evaluations in general (Table 13), their impact may vary across different types of seekers. For example, those who are more susceptible to cognitive anchoring or who possess greater domain expertise might be affected differently by the problem specification structures during evaluations. Future research can examine how problem specification structures shape different seekers' assessments, affecting the range of their evaluations.

Third, more broadly, advances in generative artificial intelligence (GenAI) could reshape the crowdsourcing landscape. Future research can investigate how seekers can use GenAI to represent problems in ways that encourage solver participation, leading to more high-quality ideas in contests. This can help address the double-edged findings we uncover in this study.

CONCLUSION

This study demonstrates how problem specification structures in crowdsourcing contests simultaneously affect both seekers and solvers. It underscores a crucial paradigm shift for future research: optimizing platform features for one stakeholder group can invariably trigger unintended cognitive and motivational consequences for another. Given these double-edged effects, future theoretical frameworks must look beyond isolated user interactions and instead account for the interconnected trade-offs inherent in the multi-sided nature of crowdsourcing contests. By understanding and accounting for these complex dynamics, we can better help all stakeholders maximize mutual value from using or joining contests.

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APPENDICES

Appendix A: Replication Results

We attempted to replicate the findings in Jiang et al. [1] using our data. Jiang et al. [1] identify two types of information seekers provide in their problem specifications: execution guidelines and conceptual objectives. Specifically, *""professionalism" and "reliability" can be considered as conceptual objectives that the seeker wants design solutions to achieve, whereas "blue color" and "sharp edges" can be considered as execution guidance that conveys the seeker's instructions for design details"* [1:638]. They operationalized execution guidelines and conceptual objectives by counting "*the keywords related to each aspect of execution guidance (e.g., colors, fonts, usages, shapes, and styles) in the problem specification*" and hiring coders to *"manually list the conceptual objectives mentioned in the problem specification for each contest"* [1:646]. We adopted their approach and hired two coders to independently read each problem specification and identify terms that related to execution guidelines (e.g., "red," "sans-serif," "round," etc.) or conceptual objectives (e.g., "modern," "simple," etc.) therein. They then aggregated the number of terms for the respective information type in the problem specifications. The interrater reliability measured by weighted Cohen's Kappa is 0.90 and 0.91 for the number of execution guidelines and conceptual objectives, respectively, indicating a strong agreement between the coders. (Our interrater reliability is comparable to weighted kappa of 0.91 in Jiang et al. [1]). Following Jiang et al. [1], we measured the execution guidelines and conceptual objectives for each problem specification by averaging the number of terms for the respective information type across the two coders. Table A1 presents the summary statistics for logo contests.

Table A1. Description of Variables and Summary Statistics

Variables	Description	Mean	SD
Conceptual Objectives	The number of conceptual objectives mentioned by seekers in each problem specification (adapted from Jiang et al. (2021b))	4.81	2.90
Concept Similarity	Average pairwise semantic similarity of coded conceptual objectives (adapted from Jiang et al. (2021b))	0.09	0.08
Execution Guidelines	The number of execution guidelines mentioned by seekers in each problem specification (adapted from Jiang et al. (2021b))	5.15	3.50
Solver Quantity	Number of participants in the focal contest	29.14	34.31
Structured	1 for after problem specification structure change, 0 for before change	0.60	0.49
Prize	Prize amount in focal contest	243.61	69.71
Guaranteed	1 if focal contest guaranteed prize, 0 otherwise	0.41	0.49
Blind	1 if focal contest allowed solvers to see others' submissions; 0 otherwise	0.12	0.32
Multi Winner	1 if focal contest had multiple winners; 0 otherwise	0.02	0.12
Contest Quantity	Number of competing contests starting on the same date as the focal contest	44.33	13.33
Seeker Experience	Number of contests launched by seekers before the focal period	0.05	0.28

Replication of Table 2 in Jiang et al. [1]. For this analysis, we restricted our dataset to the pre-treatment contests. This is because the corresponding analysis in [1] involved only contests when the problem specifications were less structured (see Figure 1(a) in [1], which corresponds to our pre-treatment period. Following [1], we also classified contests based on whether they had few or many conceptual objectives. *ShortCcpt* is 1 (0) if the seekers stated less than or equal to (greater than) 3 conceptual objectives.

Table A2 presents the results. In Model 1, we used all pre-treatment logo contests and included contest-level controls. In Model 2, we followed [1] to sample only the "*contests in which the design seekers promise to award $200 to one and only one final winner*" [1:646]. *Conceptual Objectives* is not significant in both models, suggesting that this factor did not affect the number of solvers in contests. Therefore, our data cannot replicate the results of Table 2 in [1].

Table A2. Results of Replicating Jiang et al. [1] Table 2

	Model 1	Model 2
DV:	**Solver Quantity**	**Solver Quantity**
Conceptual Objectives	0.10 (0.28)	0.41 (0.26)
Concept Similarity	-0.02 (0.06)	0.00 (0.05)
Conceptual Objectives x ShortCcpt	-0.32 (0.88)	-0.40 (0.68)
ShortCcpt	-0.96 (2.58)	1.25 (2.23)
Execution Guidelines	0.10 (0.17)	-0.02 (0.14)
Prize	0.35*** (0.03)	
Guaranteed	11.38*** (1.55)	
Blind	-17.64*** (1.92)	
Multi Winner	4.68 (9.40)	
Contest Quantity	-0.51*** (0.11)	
Seeker Experience	0.92 (1.61)	
Day-of-week, month, year dummies	Yes	Yes
Industry fixed effects	Yes	Yes
Observations	1,287	752
R^2	0.51	0.16
Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*		

Replication of Table 4 in Jiang et al. [1]. Section 6 of Jiang et al. [1] examines the effect of conceptual objectives on the number of solvers in contests using a problem specification update implemented by the platform. They found that the change led seekers to disclose fewer conceptual objectives. As a result, contests posted after the update attracted more solvers. Using their data sampling method, we also focus on *"contests in which the design seekers promise to give a $200 award to one and only one winner"* [1:651]. Table A3 presents the results. In Model 1, after controlling for the effects of conceptual objectives and execution guidelines (neither is significant), *Structured* is negative and significant. This implies that the number of solvers in contests decreased after the problem specifications became more structured, which is consistent with H2. In Model 2, we included the *Structured x Conceptual Objectives* interaction, following Jiang et al. [1]. The coefficient of *Structured* remains negative and significant. Hence, changes in the number of conceptual objectives and execution guidelines in the problem specifications, resulting from the change in structuredness, if any, did not (fully) account for the change in the number of solvers in contests, contradicting the findings in Jiang et al. [1].

Table A3. Results of Replicating Jiang et al. [1] Table 4

	Model 1	Model 2
DV:	**Solver Quantity**	**Solver Quantity**
Structured	-6.05*** (0.97)	-4.77*** (1.35)
Conceptual Objectives	0.15 (0.11)	0.24 (0.15)
Execution Guidelines	-0.06 (0.09)	-0.07 (0.09)
Structured x Conceptual Objectives		-0.27 (0.21)
Day-of-week, month, year dummies	Yes	Yes
Industry fixed effects	Yes	Yes
Observations	1,936	1,936
R2	0.13	0.13
Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*		

References

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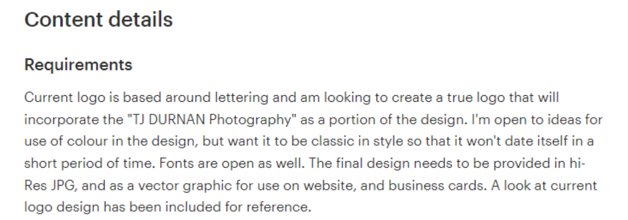
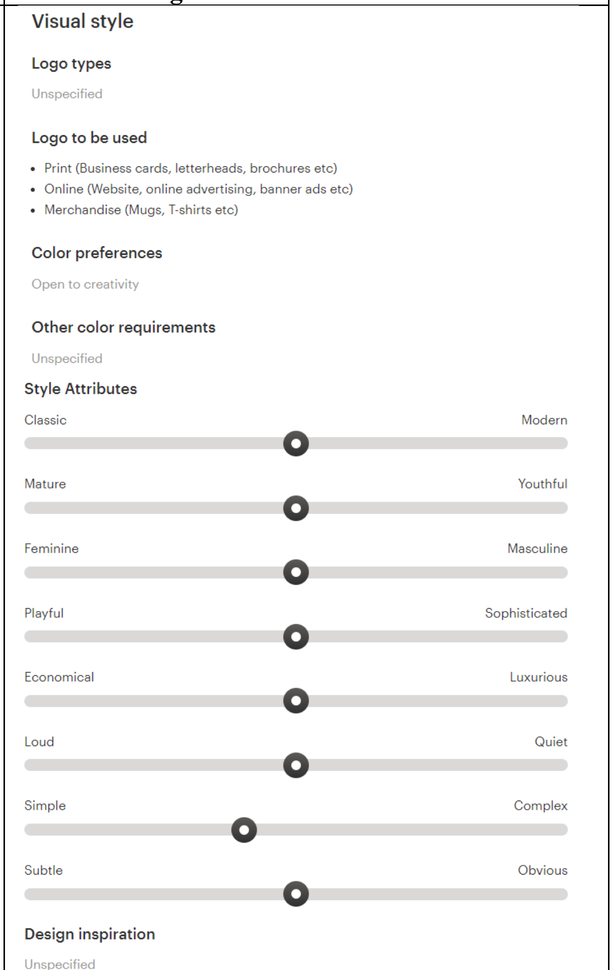
Appendix B: Examples of Problem Specification Structure on 99designs

Figure B1: Less Structured



https://99designs.com/logo-design/contests/photographer-branding-logo-60044/brief (accessed: July 2026).

Figure B2: More Structured



https://99designs.com/logo-design/contests/wanted-shaker-logo-design-68076/brief (accessed: July 2026).

Appendix C: Problem Specification Informativeness

To determine whether the change in the structuredness of the problem specifications affected their informativeness, we compared the details seekers provided in their logo contests before and after the change (see Table C1). Specifically, we examined whether seekers described their organization, mentioned their industry, and specified the slogan to incorporate, logo types and usage, preferred color, and visual attribute requirements.

Table C1. Coding of Problem Specification Informativeness Attributes (Logo Contests)

Detail	Before Change: Less Structured	After Change: More Structured
Described organization	Whether seeker provided relevant information in the field Description of the organization and its target audience	
Mentioned industry	Whether seeker mentioned which industry their company belonged to	
Specified slogan to incorporate	Whether seeker asked to incorporate slogan into the logo	Whether seeker provided relevant information in the field Slogan to Incorporate in the Logo
Specified logo types	Whether seeker mentioned the types of logos, e.g., word, pictorial, etc., in the Requirements section	Whether seeker provided relevant information in the field Logo Types
Specified logo usage	Whether seeker mentioned how their logo will be used, e.g., print, online, screen, etc., in the Requirements section	Whether seeker provided relevant information in the field Logo to Be Used
Specified preferred colors	Whether seeker mentioned their preferred colors in the Requirements section	Whether seeker provided relevant information in the field Color preferences
Specified visual attributes requirement	Whether seeker mentioned requirements related to visual style in the Requirements section	Whether seeker specified any dimensions in the field Style Attributes or mentioned any visual style requirements in the field Other Notes

Our analyses show no significant differences in most attributes before and after the structure change (see Table C2). Although the proportion of seekers (M = 0.95, SD = 0.21) who specified visual attribute requirements after the structure change was larger, it was already very high (M = 0.89, SD = 0.31) even before the change.

Table C2. Problem Specification Informativeness (Logo Contests)

Proportion of seekers who:	Less Structured (N=1287)	More Structured (N=1932)	p-value
Described organization	1.00 (0.00)	1.00 (0.03)	0.41
Mentioned industry	0.99 (0.10)	0.98 (0.13)	0.24
Specified slogan to incorporate	0.01 (0.10)	0.00 (0.00)	1.00
Specified logo types	0.89 (0.31)	0.90 (0.29)	0.18
Specified logo usage	0.93 (0.25)	0.95 (0.23)	0.21
Specified preferred colors	0.75 (0.43)	0.73 (0.45)	0.19
Specified visual attributes requirement	0.89 (0.31)	0.95 (0.21)	< 0.001

Appendix D: Correlation Matrices

Panel A: Seeker Side (Industry-Day Level)

	[1]	[2]	[3]
[1] Contest Quantity	1.00		
[2] Structured	0.05	1.00	
[3] Logo	0.22	0.01	1.00

Panel B: Solver Side (Solver-Week Level)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
[1] Solver Quantity	1.00											
[2] Quality-Idea Quantity	0.23	1.00										
[3] Structured	-0.13	-0.04	1.00									
[4] Logo	0.14	0.03	0.01	1.00								
[5] Prize	0.18	0.07	-0.00	-0.73	1.00							
[6] Guaranteed	0.22	0.18	-0.01	-0.01	0.06	1.00						
[7] Blind	-0.08	-0.02	-0.11	-0.43	0.40	0.05	1.00					
[8] Multi Winner	0.03	0.08	0.00	-0.02	0.07	0.02	0.02	1.00				
[9] Contest Quantity	0.02	-0.01	0.37	0.68	-0.49	-0.03	-0.34	-0.01	1.00			
[10] Seeker Experience	-0.01	-0.01	-0.03	-0.19	0.09	0.00	0.20	-0.01	-0.14	1.00		
[11] Execution Guidelines	0.09	0.06	-0.05	0.23	-0.14	0.05	-0.11	0.01	0.14	-0.04	1.00	
[12] Conceptual Objectives	0.05	0.02	0.05	0.11	-0.04	0.03	-0.07	0.02	0.09	-0.04	0.16	1.00

Appendix E: Examples of Problem Specification in Pre-treatment Period

Figure E1: Low Structuredness

Content details

Requirements

We need the first impression! We need the look that says who we are. We need simple and elegant. We would like the creative to represent the innovation of the service which is directly related to “capturing” pixels. I thought of a butterfly net coming down on a butterfly made of primary pixels.. I also thought of a net capturing one of the letters in the company’s name: ‘Slideplan’. We are looking for the logo that goes at the top right of the homepage of our website plus the little round cornered square that represents a mobile app. In other words, we want to brand Slideplan. In the logo the text must be read well i.e. at a glance the user understands that we are “Slideplan”, having said that it’s possible that the creative changes the font colors such as YouTube does with it’s logo (or not). There are three parts to the services: a Slideplan creator, Slideplan viewer, and the Slideplan network that allows the user to transfer the Slideplans around the digital world, be it other PCs, iPhones, Androids devices, and etc. We want something that speaks of the digital world, the one that’s soon to supplement our future. Our service with help guide and plan that future and we need an image that speaks to that.

https://99designs.com/logo-design/contests/professional-designers-out-box-branding-logo-needed-62594/brief (accessed: July 2026).

Figure E2: High Structuredness

Content details

Requirements

The Feel...
We want a modern, fresh logo which is still emotionally engaging while still remaining professional...We are looking for a logo that is clean and crisp. Playful okay, but not cartoon type.
Classy but not too fancy. Professional but NOT conservative.
No stock images or clip art in logo.

Colors...
We are open to your ideas. Eclipse would signify dark, yet I do not want dark. I would like it to stand out with bold colors. Even more sun than moon, would be a good way to describe it.
feel free to experiment with colors

Layout...
Name in logo or logo with name separate. Not sure what we want. Would love to see your creativity there. We really do not have a design in mind. We are going in with an open mind.

Will need to use on many platforms:
Website/blog
Business cards
Letterhead
shirts/hats
facebook page

https://99designs.com/logo-design/contests/logo-social-media-consulting-company-60909/brief (accessed: July 2026).

Figure E3: Mid Structuredness

Content details

Requirements

The brand needs to demonstrate forward out-of-the-box thinking ... there should be nothing ordinary about the feel of the logo and how it would look in a business card layout.

How we do business in today's market place is only limited by our individual and collective imagination ... so my brand needs to demostrate Imagination and Multiple Dimensional. I would like to see Highlights and Shadows used as well as Size Variations with in the logo.

Tilt things - try different shapes - angles & curves ... I want people looking at to go .. Wow, I wouldn't have thought to do that! It also needs to look clean, cutting edge and professional ... BUT more importantly it can't be too corporate as I'm all about Making Business Personal! Don't be affraid to through in FUN elements.

Colors: I prefer Earth Tones ... burnt orange, sage greens, steal blues, browns, greys, autum reds.

Files: Need artwork in Photoshop file format as well as high res. .JPEG

When you look at the brand it should fall between these bookend of branding that I feel would respresent my company best:
Professional - Personal/Casual
Accomplished/Wise - Fun
Experienced - Forward Thinking & Hip/Savy
Demanding - Open Minded
Realistic - Versatile/Flexible
Elite - Collaborative
Out of the box - Down to Earth
High Energy - Focused
Contemporary - Timeless
Leader - Implementor

Wow Me - Bonus$ Available.

https://99designs.com/logo-design/contests/professional-designers-out-box-branding-logo-needed-62594/brief (accessed: July 2026).

Appendix F: Further Evidence from Webpage Contest Structure Change

Figure F1. Problem Specification Structure for Webpage Contests

Before Format Change

Background Information
- Company Name [text]
- Overview [text]
- Description of the Organization and Its Target Audience [text]

Content Details
- Requirements [text]
- Number of Pages [text]
- Page Descriptions [text]
- Existing Website [text]
- Example Websites [text]

References
- Attachments [file upload]

Contest Deliverables
- Final Files
  - Screen Quality [choice set]
  - Fonts [text]

After Format Change

Background Information
- Organization name [text]
- Description of the Organization and Its Target Audience [text]
- Industry [text]
- Existing Website [text]

Visual Style
- Style/Theme Ideas [text]
- Inspirational Websites [text]

Content Details
- Page Descriptions [text]
- What to Avoid [text]

Other
- Other Notes [text]
- Attachments [file upload]

Contest Deliverables
- Final Files
  - Screen Quality [choice set]
  - Fonts [text]

Note: Input type for each field is in the square brackets.

Six weeks after the structure change for logo contests, the platform changed the problem specification structure for webpage contests. Figure F1 shows the stylized structures of webpage contests before and after the change. Table F1 presents the results of the impact of the change for webpage contests. In Model 1, *Webpage x Structured* is positive, as H1 suggests, but not significant; the number of webpage contests increased by only 3.05% after the change. This may be because the structure change for webpage contests was relatively minor, and its impact on seekers was thus less pronounced than that of the logo contests in our main analysis. For example, the new problem specification structure for webpage contests still required substantial text input from seekers, whereas that for logo contests involved more multiple-choice questions and slider bars. In Model 2, the negative *Webpage x Structured* indicates that 17.30% fewer solvers participated in contests with more structured problem specifications, aligning with H2. We further examine the effects of the structure change on idea quality. In Model 3, the coefficient of *Webpage x Structured* is negative but not statistically significant. In Model 4, the negative *Webpage x Structured* is significant, implying the number of high-quality ideas receiving 4 or 5 stars decreased after the change in the structuredness of problem specifications. On average, seekers obtained 13.93% fewer such ideas in their contests after the change. These results provide some support for H3.

Next, we validated our theory by examining solver-level behaviors and outcomes. In Model 5, *Webpage* *x Structured* is negative, indicating that solvers participated in significantly fewer webpage contests when the problem specifications became more structured. Specifically, they joined 12.19% fewer webpage contests after the change. In Model 6, *Webpage x Structured* is positive, implying that solvers generated more high-quality ideas when problem specifications were more structured. Our estimates indicate that solvers generate 33.64% more high-quality ideas in contests with more structured problem specifications. These findings support the arguments in our theorizing.

Table F1. Impacts of Problem Specification Structure of Webpage Contests

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
DV:	**Contest Quantity**	**Solver Quantity**	**Quality-Idea Quantity**	**Quality-Idea Quantity (4-5 Star)**	**Contests Participated**	**Quality-Idea Quantity per Solver**
Webpage x Structured	0.03 (0.11)	-0.19** (0.06)	-0.08 (0.06)	-0.15*** (0.03)	-0.13*** (0.03)	0.29*** (0.08)
Webpage	-0.79*** (0.04)	-1.88*** (0.07)	-0.54*** (0.07)	-0.35*** (0.03)	-0.58*** (0.05)	-0.14** (0.05)
Prize		0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)		
Guaranteed		0.47*** (0.02)	0.74*** (0.02)	0.65*** (0.01)		
Blind		-0.28*** (0.03)	-0.16*** (0.03)	-0.17*** (0.01)		
Multi Winner		-0.06 (0.07)	0.67*** (0.05)	0.66*** (0.03)		
Contest Quantity		-0.00*** (0.03)	-0.00 (0.00)	-0.00*** (0.00)		
Solver Quantity			0.00*** (0.00)	0.00*** (0.00)		
Contests Participated						0.01*** (0.00)
Industry fixed effect	Yes	Yes	Yes	Yes	No	No
Solver fixed effect	No	No	No	No	Yes	Yes
Week fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,254	4,347	4,347	4,347	45,072	45,072
Pseudo R^2	0.40	0.08	0.09	0.14	0.58	0.52
Unit of analysis	Industry-Day	Contest	Contest	Contest	Solver	Solver
Regression	Negative Binomial	Negative Binomial	Poisson	Poisson	Negative Binomial	Poisson

Robust standard errors in parentheses. * *p < .05* ** *p < .01* *** *p < .001*