Optimal Duration of Innovation Contests

Today, a vast majority of top global brands utilize crowdsourcing to generate solutions to a variety of problems (Chen et al. 2018). As crowdsourcing has turned into a legitimate business tool, online crowdsourcing platforms such as InnoCentive and NineSigma have enjoyed significant growth, organizing regular competitions called innovation contests on behalf of organizations such as Siemens, Pfizer, Unilever, and NASA. In an innovation contest, an organizer announces an innovation-related problem along with a contest duration and an award scheme to a group of independent agents. Agents participating in the contest exert efforts to develop solutions within the announced duration, and then the organizer awards agents submitting the best solutions based on the announced award scheme. Although the contest duration is considered an important strategic decision by practitioners, it has received only cursory attention in the academic literature. In this paper, we aim to fill this gap by providing insights into the optimal contest duration in relation with the optimal award scheme.

Online platforms such as InnoCentive and NineSigma run numerous contests for their customers, generating $1 billion in revenue with an annual growth rate of 37.1% (Chen et al. 2018). For example, InnoCentive serves its customers by encouraging its member agents to submit innovative solutions to various problems. Based on customer needs, InnoCentive offers different contest types. In particular, an ideation challenge seeks ideas, a theoretical challenge elicits theoretical solutions, and a reduction-to-practice (RTP) challenge seeks theoretical solutions along with working prototypes. For instance, a recent ideation challenge of NASA elicits ideas that protect astronauts from galactic cosmic rays whereas a recent RTP challenge of NASA elicits applications that provide new insights into the global climate change using climate and earth sciences satellite data. The duration of a contest at InnoCentive is closely related to its type. For instance, an RTP challenge often features a longer contest duration than an ideation or a theoretical challenge.

Practitioners consider contest duration as an important operational decision because the contest duration affects agents’ incentives as well as an organizer’s profit.¹ Despite its practical relevance, the contest duration has been overlooked in the operations literature. We aim to contribute to the contest theory and practice by providing insights into how an organizer should decide on the contest duration along with the award scheme. Specifically, we answer the following research questions:

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(Q1) How does the optimal contest duration change with the problem characteristics of a contest?
(Q2) What is the relationship between the optimal contest duration and the optimal award scheme?

To answer these research questions, we develop a normative model of an innovation contest where an organizer decides on the contest duration and the award scheme to maximize his discounted payoff from the contest minus the total award given to agents. The organizer’s payoff improves with the quality of agents’ solutions, but it is discounted with the contest duration because the organizer obtains agents’ solutions later. Given the contest duration and the award scheme, each agent decides on whether to participate in the contest or not. If an agent chooses to participate in the contest, she exerts effort to improve the quality of her solution, which is also subject to an output uncertainty. Each agent maximizes her expected award from the contest minus the cost of her effort, which increases with her effort and decreases with the contest duration.

We first characterize the optimal contest duration for a given award scheme. We identify the following effects of the contest duration that seem to coincide with practice. We show that a longer contest duration increases each agent’s effort, so improve the quality of her solution, thereby improving the organizer’s profit. Yet, as discussed above, the organizer’s payoff is discounted more as the contest duration increases. Moreover, a longer contest duration may hinder an agent’s participation because the agent may anticipate that winning an award requires too much effort. We establish that as a result of these three effects, it is always optimal for the organizer to limit the contest duration, but the intrinsic trade-off that drives the optimal contest duration depends on how urgently the organizer requires agents’ solutions. When the organizer urgently requires solutions, the effort-discounting trade-off drives the optimal contest duration. When the organizer does not urgently require solutions, however, the effort-participation trade-off drives the optimal contest duration. Interestingly, our interviews with InnoCentive and NineSigma have revealed that the effort-participation trade-off seems to be the driver for how these platforms determine the contest duration because only a small portion of their customers urgently require solutions.

Regarding our first research question, we establish that when the organizer does not urgently require solutions, the optimal contest duration increases with the agent’s output uncertainty, and decreases with the marginal impact of the agent’s effort on the quality of her solution (hereinafter, the agent’s effort coefficient). The intuition is as follows. As the agent’s output uncertainty increases or her effort coefficient decreases, the impact of her effort on her expected award decreases. This
induces the agent to decrease her effort, which also increases the likelihood of her participation. Thus, as the agent’s output uncertainty increases or her effort coefficient decreases, the organizer can increase the contest duration to induce agents to exert more efforts. This result suggests that the optimal contest duration may increase with the novelty and the sophistication of solutions that the organizer seeks, which seems consistent with practice. For example, RTP challenges at InnoCentive often feature a longer contest duration than theoretical and ideation challenges at InnoCentive.

We next analyze the relationship between the optimal contest duration and the award scheme. First, we show that when the organizer is unwilling to wait for solutions, it is optimal for the organizer to adopt a winner-take-all (in short WTA) award scheme that gives an award only to the agent with the best solution. Second, and more interestingly, we establish that the WTA award scheme is no longer optimal when the organizer is willing to wait for solutions. In this case, it is optimal for the organizer to give multiple awards, and the total weight of the winner award decreases as the organizer needs solutions less urgently. This result may explain why a significant number of contests at platforms give multiple awards because as discussed above, organizers at platforms are often willing to wait for solutions. Third, we identify a positive correlation between how the contest duration and the magnitude of total award change with the agent’s output uncertainty and her effort coefficient. An implication of this result is that there is a positive correlation between the contest duration and the winner award when a contest adopts the WTA award scheme. Interestingly, this positive correlation is corroborated by empirical evidence (Yang et al. 2009, Shao et al. 2012). Although these papers do not offer a mechanism behind this positive correlation, our results suggest that a plausible mechanism can be how the contest duration and the winner award change with the agent’s output uncertainty or her effort coefficient (or both).

References

