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Diversity of community members and communication between them:

Effects on contest performance

Poonam Oberoi
Grenoble Ecole de Management
Marketing
poonamind2000@yahoo.com

Christophe Haon
Grenoble Ecole de Management
Marketing
christophe.haon@grenoble-em.com

Abstract

Many studies show that open innovation contests are increasing in number and importance (Geiger et al., 2011; Kristensson, Gustafsson and Archer, 2004). However, we don?t have a good understanding of how these contests work in practice (Boudreau, Lacetera and Lakhani, 2011). Hence, in this paper we focus on how to attain performant open innovation contests. Which factors, besides the contest structure, should firm try to leverage in order to have performant contests? How much of the variance in the contest performance can be explained by community members related factors? Which variable is the best predictor of contest performance? Attending to these contest performance related issues is important because these contests are normally organized in the early stages of the open innovation process and the greater the number of good ideas, that the firm has in these initial phase, the better. If the open innovation contest is performant, then it increases the likelihood of getting number of good quality ideas, which ultimately increases the probability of producing novel goods or services.

Addressing these questions empirically is challenging. In this paper, we analyze 173 contests, proprietary data provided by eYeka, an open innovation platform based in Paris. This unique data set provide us with the opportunity to study heterogeneous contests through similar measures. We formally test our hypotheses with a multiple regression model and simple slopes analysis.

The main attribute of the existing studies is that importance is given to the contest structure, such as contest size (Boudreau, Lacetera and Lakhani, 2011), rewards (Bullinger et al., 2010), contest duration (Ebner et al., 2009), and problem description (Terwiesch and Xu, 2008) as potential factors impacting the contest performance. Our thesis is that the focus should also be on factors such as (a) skills diversity of participating community members (PCM), and (b) communication between PCM. Importance that is given to these two factors in the open innovation and team literature lacks in the context of open innovation contests. Moreover, in practice contest organizers juggle with these factors but

there is no concrete idea as to how to use them to make contests performant.

We have the three theoretical contributions, which are as follows: First, we empirically show that skills diversity has an inverted U-shaped relationship to contest performance. With this contribution we participate in the on going conversation in the open innovation search literature (Laursen and Salter, 2006) and suggest that even in the context of open innovation contest searching widely for ideas has a curvilinear relationship with performance. Second, we demonstrate through our analysis that communication amongst PCM has a positive impact on contest performance. This suggests that allowing for communication between PCM is productive for contest performance. Third, our analysis reveals that skills diversity of PCM moderates the relationship between communication amongst PCM and contest performance. This implies that the effects of communication amongst PCM are less positive under high diversity of PCM than under low diversity. Our managerial contributions are as follows: First, contest managers should control for skills diversity of PCM. Searching for external actors with very diverse skills can be counter-productive for the contest. Second, Managers should in general encourage communication. However, if during a contest, managers feel that the skills diversity level of PCM is getting high then control for the communication between PCM. If on the other hand, level of skills diversity of PCM is low certain level of communication can lead to positive impact on contest performance.

In this article we argue that though the contest structural factors are very important they are however under full control of the contest managers (Yang, Chen and Pavlou, working paper) and (s)he will do everything to reduce any inefficiency caused by these factors. Our thesis is that the focus should also be on factors such as communication and diversity of PCM. The level of diversity of participating community members in a contest is only partially in control of contest manager. But depending on the level of diversity the communication between PCM can be manipulated to attain performant contest.

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Title : Diversity of community members and communication between them: Effects on contest performance

Abstract :

How to attain performing open innovation contests? Which factors, besides the contest structure, should firm try to leverage in order to have performing contests? Empirical findings, based on a study of 173 contests, support the inverted U-shaped effect of skills diversity of community members on performance of the open innovation contests. We also demonstrate that communication between participating community members (PCM) has a positive impact on contest performance. Lastly, our analysis reveals that skills diversity of PCM moderates the relationship between and contest performance. This implies that the effects of communication amongst PCM are less positive under high diversity of PCM than under low diversity.

Keywords : open innovation contests, diversity of community members, communication

Introduction:

Many studies show that open innovation contests, which can be defined as contests being posted online by individual firm or open innovation platforms (such as Innocentive) to which external actors contribute in return for rewards, are increasing in number and importance (Geiger et al., 2011; Poetz and Schreier, 2013; Kristensson, Gustafsson and Archer, 2004). However, we don't have a good understanding of how these contests work in practice (Boudreau, Lacetera and Lakhani, 2011). Hence, in this paper we focus on *how to attain performing open innovation contests*. *Which factors, besides the contest structure, should firm try to leverage in order to have well functioning contests*? *How much of the variance in the contest performance can be explained by community members related factors? Which variable is the best predictor of contest performance?* Attending to these contest performance related issues is important because these contests are normally organized in the early stages of the open innovation process and the greater the number of good ideas, that the firm has in these initial phase, the better. If the open innovation contest is performant, then it increases the likelihood of getting number of good quality ideas, which ultimately increases the probability of producing novel goods or services.

Addressing these questions empirically is challenging. A most basic condition is simply finding a large sample of heterogeneous open innovation contests. To discern the enigma of contest performance, we also require precise measures of key variables, including objective measures of contest outcomes. In this paper, we analyze 173 contests, proprietary data provided by eYeka, one of the leading open innovation platform, which is based in Paris. This unique data set provide us with the opportunity to study

heterogeneous contests through similar measures. We formally test our hypotheses with a multiple regression model and simple slopes analysis.

The main attribute of the existing studies is that importance is given to the contest structure, such as contest size (Boudreau, Lacetera and Lakhani, 2011), rewards (Bullinger et al., 2010), contest duration (Ebner et al., 2009), and problem description (Terwiesch and Xu, 2008) as potential factors impacting the contest performance. Our thesis is that the focus should also be on factors such as (a) skills diversity of participating community members (PCM), and (b) communication between PCM. Importance that is given to these two factors in the open innovation and team literature lacks in the context of open innovation contests. Moreover, in practice contest organizers juggle with these factors but there is no concrete idea as to how to use them to make contests performant.

In this article we make four theoretical contributions. First of all we elaborate on different type of diversity and their impact on contest performance. We illustrate that skills and status diversity differ in their impact on contest performance. Secondly, we empirically demonstrate that skills diversity has an inverted U-shaped relationship to contest performance. With this contribution we participate in the on going conversation in the open innovation search literature (Laursen and Salter, 2006) and suggest that even in the context of open innovation contest searching widely for ideas has a curvilinear relationship with performance. Thirdly, our analysis shows that communication amongst PCM has a positive impact on contest performance. Finally, we reveal the notion that skills diversity of PCM moderates the relationship between communication amongst PCM and contest performance. This implies that the effects of communication amongst

PCM are less positive under high diversity of PCM than under low diversity.

In this article we propose three managerial contributions. First, contest managers need not search for external actors with very diverse skills. Searching for external actors with very diverse skills can be counter-productive for the contest. Second, contest managers should in general encourage communication between PCM during the contest, except during very high level of skills diversity. If on the other hand, level of skills diversity of PCM is low communication can lead to positive impact on contest performance.

This paper proceeds as follows. The first section reviews the relevant literature and develops basic hypotheses. The second section details the empirical context of our study, describes the data, and the statistical model. The results of the empirical analyses are reported in the third section along with the additional analyses. The fourth section summarizes our theoretical and managerial contributions and offers concluding remarks on the limitations of this study.

Theoretical Framework:

According to a preliminary data on 14 large open innovation or crowdsourcing platforms, i.e. intermediary firms with a community that conduct contest, revenues grew 74% between 2010 and 2011, and 53% a year earlier. These platforms had total incomes of about $50 million[1]. Estimates are that the whole "contests industry" might have a value between $1 and $2 billion (McKinsey & Company, 2009). These figures

[1] http://online.wsj.com/article/SB10001424052970204409004577157493201863200.html

demonstrate that the open innovation contests[2] have rocketed in last few years, even if the phenomenon in itself is known to be of use since centuries (Lampel, Jha and Bhalla, 2012).

Many studies demonstrate that there are multiple reasons why open innovation or crowdsourcing contests are becoming important besides the obvious one that companies can tap into a large and diverse pool of ideas (Geiger et al., 2011). First, ideas generated in contests by external actors score high in novelty and customer benefit whereas professionals tend to produce more feasible and incremental ideas (Poetz and Schreier, 2013; Kristensson, Gustafsson and Archer, 2004). Second, open innovation contest is a tool for firms to figure out how their customers perceive them, their demands and requirements, which concept should be further developed, whether the product is likely to be a success and what is the most suitable price for a new product (Voigt and Ernst, 2012). Third, open innovation platforms ensure truthful transaction of Intellectual Property Rights (IPR) and rewards between their client firms and community members (Vukovic, 2009). Fourth, open innovation contests help identify lead users (von Hippel, 2009).

Following the concepts of open innovation, co-creation or crowdsourcing, firms on their own or via the open innovation platforms are increasing the use of contests to foster the generation of novel and creative ideas (Hutter et al., 2011). Nonetheless, research shows that companies use contests irregularly and unsystematically (Voigt and Ernst, 2012). While the use of contests in increasing they remain peripheral to the R&D

[2] Open innovation contest has also been referred to in the existing literature as: innovation contest (Boudreau, Lacetera and Lakhani, 2011), technology contest (Cohen, Kaplan and Sela, 2008), innovation tournaments (Terweisch and Xu, 2008) and tournament for ideas (Morgan and Wang, 2010).

that relies on firm's employees (Lampel, Jha and Bhalla, 2012; Neyer, Bullinger, & Moeslein, 2009). Researchers (Voigt and Ernst, 2012) explain that the reason behind this could be multifold. Companies (1) express concerns about protection and exploitation of the intellectual property, (2) feel that if there were too many contests their perception and external actors' participation might decrease, and (3) feel contests represent extra manpower, time and cost. However, open innovation platforms such as InnoCentive, eYeka, HYVE AG etc can resolve the above mentioned issues as they have quick results at limited costs (Malone, Laubacher and Johns, 2011, Lampel, Jha and Bhalla, 2012), can keep their client firm's identity hidden and can ensure truthful intellectual property rights versus rewards transaction (Vukovic, 2009). What hinders hence the systematic and regular use of open innovation contests? Firms as well as open innovation platforms can organize contests but there is no established way of conducting efficient open innovation contests. The existing literature does not provide sufficient guidelines about how to devise performing open innovation contests. This may be because (1) in order to be performing each contest needs to adapt to the idiosyncratic requirements of the firm's context and the problem (Lampel, Jha and Bhalla, 2012), and (2) the existing publications are dominated by single case studies. This methodological trend leads to in-depth knowledge silos on individual cases with only limited possibilities for generalization (Bullinger and Moeslein, 2010). However, as the open innovation contests are increasing in number and importance, we need to have a better understanding of how these contests work in practice (Boudreau, Lacetera and Lakhani, 2011; Jeppesen and Lakhani, 2010; Terweisch and Ulrich, 2009) and how to attain performant open innovation contests.

The bulk of the literature on open innovation or crowdsourcing contest is

regarding (1) its potential as a tool for virtual customer and user integration in the open innovation process (Voigt and Ernst, 2012), (2) the benefits of using external actors as opposed to firm's internal professionals (Poetz and Schreier, 2013) and, (3) how to motivate external actors to participate in these contests (Boudreau, Lacetera and Lakhani, 2011). Yet, a small, and recent stream of literature in management and marketing has started focusing on contest structure and performance relationship (Boudreau et al., 2008; Bullinger et al., 2009; Terwiesh and Xu, 2008, Boudreau, Lacetera and Lakhani, 2011). In particular, authors note that the nature of the problem, reward arrangement, contest architecture and number of contributors might have an important effect of contest performance. For example, Yang, Chen and Pavlou (2010, working paper) propose that a contest with higher award, shorter description length, shorter duration, and less complex task, can make solvers submit their solutions faster. A contest with higher award, longer duration, less complex task and faster submission speed can capture more solvers. Boudreau, Lacetera and Lakhani (2011), for instance, question the impact of number of participants on contest performance. Although Laursen and Salter (2006) prove the inverse U-shaped relationship between diversity of participants and open innovation performance, there is no study demonstrating a link between diversity of participating community members and contest performance, in the context of open innovation contests. This deserves attention because while organizing for open innovation contests, firms are open to varying level of diversity of community member (Brabham, 2009; Carvalho, 2009; Bullinger et al., 2009) and there is no clear indication as to what type (skills or status diversity) and level of diversity of community members will lead to efficient contests. Unfortunately, despite the recent advances, research is this area

continues to be limited, disparate and somewhat equivocal (Boudreau, Lacetera and Lakhani, 2011; Jeppesen and Lakhani, 2010; Terweisch and Ulrich, 2009). We do not have a unifying framework yet that parsimoniously explains how to attain efficient open innovation contests.

In this article, we introduce a concept that might help provide such a unifying framework. We argue that an important factor separating many efficiently organized contests from other contests is *communication between PCM*. *Communication* between PCM reflects whether or not the contest organizer allows participating community members to interact with one another with regards to their submissions. In the open innovation literature communication is either promoted or not in order to motivate external actors to participate in the open innovation contests. However, we have observed that open innovation platforms such as eYeka and Hyve do opt for different degrees of communiation between PCM and hence it deserves our due attention. For example, eYeka not only promotes communication during a contest by allowing to participating community members to see and interact about each others' submissions, it has also started organizing "Meetups[3]" – these are events in which community members meet with one another and with eYeka personnel, and discuss their creative ideas and endeavours.

Communication between PCM is critical because, regardless of the contest structure, the diversity of participating community members may vary and in order to be efficient and to exploit as best as possible the diversity, the communication needs to be manipulated. In particular, when people have homogeneous skills (i.e low skill diversity) communication nature is the better option because then community members can work

[3] See http://www.meetup.com/eYekaU/, accessed on 12/06/2013.

together as they can understand each others' contributions well and hence lead to an efficient contest. Thus skill diversity of participating community members moderates the relationship between communication and contest efficiency. Although contest managers have limited control over skills and status diversity of participating community members, they have considerable influence over communication between PCM during the contest.

The subsequent section relates diversity and communication to contest efficiency.

Diversity of PCM and contest performance:

Impact of diversity of participating actors on performance has already been emphasized in the alliance literature (Beers and Zand, 2013), in the new product development literature (Haon, Gotteland and Fornerino, 2008), and in the open innovation literature (Laursen and Salter, 2006). Haon, Gotteland and Fornerino (2008) distinguish between competence and functional diversity in the domain of new product development. We borrow their logic to do the same with skills and status diversity of community members in the context of open innovation contests. Skills diversity denotes the heterogeneity of participating community members in terms of their skills (for instance if a participating community members has video-making skills or photography skills). Where as status diversity refers to the heterogeneity of participating community members in terms of their functional status (for example if a participating community member is a student or a professional). Haon, Gotteland and Fornerino (2008) explain how in the literature, status diversity is often used as a proxy to measure skills diversity. The underlying hypothesis claims that community members with status diversity bring diverse skills. However, community members with same status might have different skills and experience, where as community members with different status might have

similar skills. Additional diversity attributes other than status diversity should hence be considered in order to comprehend the diversity of community members. Therefore, we propose a more comprehensive study of diversity of community members by considering skills and status diversity.

Empirical research in the management literature presents contradictory results in regards to the impact of functional or status diversity. On the one hand, studies show that functionally diverse teams are more innovative (Bantel and Jackson, 1989), develop clearer strategies (Bantel, 1983), can lead team members to learn cooperative skills (Beers and Zand, 2013), respond more aggressively to competitive threats (Hambrick, Chou and Chen, 1996), and can lead to quicker implantation of certain kinds of organizational change (Williams, Hoffman and Lamont, 1995) than functionally homogeneous teams. One the other hand, another set of empirical studies suggests that functional or status diversity can increase conflicts (Pelled, Eisenhardt and Xin, 1999), slow competitive response (Hambrick, Chou and Chen, 1996), and even compromise performance (Simons, Pelled and Smith, 1999). Therefore, according to the existing literature functional or status diversity could have mixed impact as it spurs innovation but also could cause conflicts and reduce efficiency (Gebert et al., 2006; Keller, 2001). The stream of literature focusing on skills or competence diversity typically suggests a positive impact of diverse skills (or competence, experience) on performance (Haon, Gotteland and Fornerino, 2008; Carbonell and Rodriguez, 2006; Sivasubhramaniam, Liebowitz and Lackman, 2012).

Based on these arguments we hypothesize that:

H1 : Status diversity of participating community members has less significant impact on contest performance than skills diversity.

As the saying goes too much of anything is bad, so is true in the case of skills or competence diversity. We borrow from the open innovation search literature (Laursen and Salter, 2006) and new product development literature (Salge et al., 2013) and suggest that too little and too much of skills diversity could be detrimental to the open innovation contest efficiency. We argue that skills diversity of participating community members could lead to an increased probability of novel linkages and thereby challenge traditional perspectives (Sethi, Smith, & Park, 2001; Laursen & Salter, 2006), which might lead to innovative product developments (Chandy & Tellis, 1998). However, at too low or too high levels of skills diversity, drawing and exploiting skills from these participating community members could either be useless or become an issue (von Hippel, 1994). The reason behind this could be that the percentage of match between the relevant skills required to solve the problem and the skills available is likely to be low. Extending on Katila and Ahuja (2002) and Laursen and Salter (2006), in order to use the highly diverse skills of the participating community members it would require intensive effort and time from contest organisers. In contrast, contest organisers have limited time to build the understanding.

Unexpected negative outcomes at too low or too high skills diversity may arise, for several reasons. First and most importantly, it could be because of low likelihood of match between the relevant skills required to solve the problem and the skills available. Individuals have specific sets of competencies and skills (Leonard-Barton, 1992). Contest organizers try their best to make the problem as specific as possible. In order for the

contest to be efficient organizers need moderate or high likelihood of match between the relevant skills required to solve the problem and the skills available (von Hippel, 1994). This is not the case in low and high skills diversity, as the likelihood of match is expected to be low because there are either too little or too many individuals with non-relevant skills. Second, when there is high skills diversity information transfer and assimilation cost could also be too high (von Hippel, 1994) rendering the contest inefficient. Third, when the skills diversity is moderate a delicate balance is established between benefits of moderately diverse skills and costs (of organization of the contest and of information transfer and assimilation).

The relationship between skills diversity of community members and contest efficiency should have an inverted U-shape, because of the trade-off between the skills to be acquired and the cost of acquiring it. High skills diversity increases the probability of contest efficiency. However, skills diversity cannot be so hinder that it would hinder experience and knowledge exchanges or communication.

Based on these arguments we hypothesize that:

H2: Skill diversity of participating community members has an inverted-U relationship with contest performance.

Furthermore, it is difficult for managers to know from the beginning of the contest - which type of skill(s) will be most rewarding and what will be the level of skill diversity in the contest. However, as the contest progresses, the organizers can anticipate the level of skill diversity of participating community members and can manipulate the communication between PCM in order to be more efficient.

Communication and contest performance:

We base our arguments regarding communication and contest performance relationship on the NPD literature. It emphasizes the importance of communication between team members and its impact on performance (Sivasubhramaniam, Liebowitz and Lackman, 2012). Extrapolating from this literature we can suggest that communication between PCM during a contest helps develop shared meanings, clarify goals and roles, foster creativity and leverage external knowledge easily (Keller, 1986; Lovelace, Shapiro, and Weingart, 2001; Ancona and Caldwell, 1992; Marrone, Tesluk, and Carson, 2007).

Based on these arguments we hypothesize that:

H3 : Communication between PCM has a positive impact on contest performance.

Skills diversity, communication and contest performance :

Communication nature has positive effects. However, there are boundary conditions. In this paper we study the degree of skills diversity which influences communication and contest efficiency relationship.

In the scenario of high skills diversity there is higher probability of having participating community members with different types of knowledge and with difference in absorptive capacity. Opting of communication in such a scenario would be counter productive because of the following reasons. First, there would be too many ideas for the participating community members to pay attention to. Second, the participating community members might try to cooperate but not have absorptive capacity for diverse skills and knowledge. Third, even if the participating community members try to develop

a shared system of codification to broaden their absorptive capacities it would be very time consuming due to the degree of skills diversity. High skills diversity of PCM could also imply low knowledge integration capabilities of the participating team members

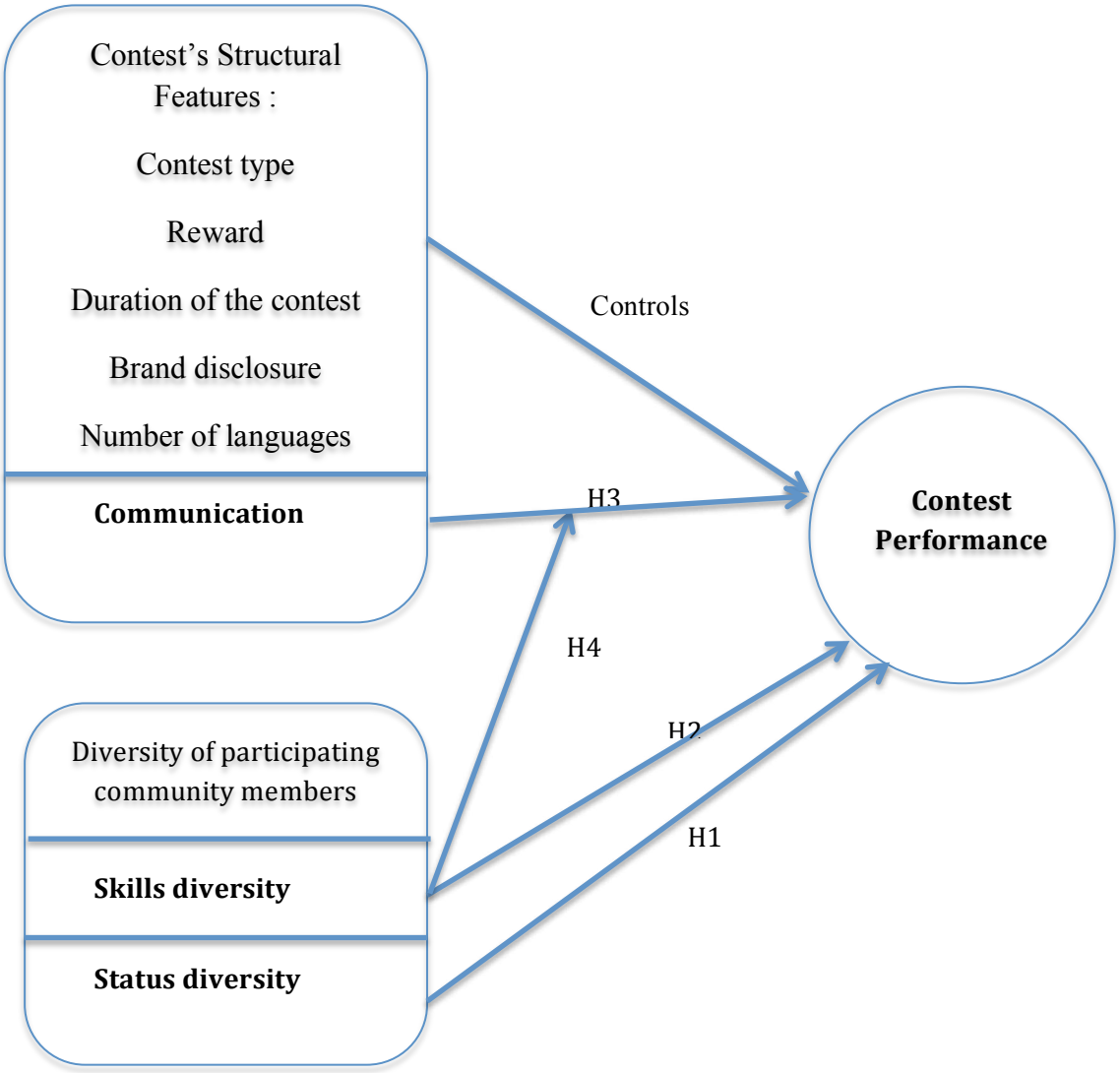
In the scenario of low skills diversity the above mentioned problems are less likely to arise and communicationis likely to create a shared system of codification and broad knowledge base which allows for better assimilation and exploitation of diverse contributions (Cowan et al., 2000).

Based on these arguments we hypothesize that:

H4: Open innovation contests that have low skills diversity and communication between PCM are likely to have a positive impact on contest performance.

We provide below a diagram summarizing our four hypotheses.

Figure 1: Hypothesized Model



Methodology:

We formally test our hypotheses with a standard multiple regression model, using the proprietary data we collected from eYeka, a leader in the 'contest industry'. This section describes the sample, measures and model used.

Sample:

Our model of contest performance focuses on skills and status diversity and communication of PCM. However, contests' structural features can also affect contest outcome. Because our focus is on diversity and communication, we controlled for the effects of contests' structural features by considering them for each contest. We initially collected data on 183 contests, conducted by eYeka between 2007 and 2012, however due to lack of information we dropped 10 contests. Our 173 contests of the dataset can be divided into five categories of contest problem: innovation, experience, packaging, communication platform, and user generated content. Roughly a fifth of the sampling frame consisted of contests in each of these categories.

We tried to ensure that the data was relevant and as complete as possible. We went through multiple stages of data collection, including (1) search of an accessible and important open innovation platform ; (2) introductory phone calls to the CEO (Mr Francois Petavy) and research fellow (Mr Yannig Roth) of eYeka ; (3) face-to-face meeting to explain the research project and get permission to collect data ; (4) mutiple discussions to explore the possible operational measures ; and (5) data compilation and sorting.

Measures :

We measured all variables at the contest level. We developed the measures using a combination of literature searches and in-depth interviews with knowledgable eYeka employees.

To measure contest perfromance, we used the ratio of number of accepted submission on total number of submissions. We measure contest performance in this manner because considering just the total number of submission is not a good enough measure. In a contest the total number of submissions can be high even when the number of valuable and acceptable entries are low. Hence we created this ratio.

To measure skills and status diversity of participating community members we calculated the entropy indices (Budescu and Bodescu, 2012) of skills and status. Per

contest, we have information on proportion of the participating community members belonging the four skills categories: animation, design, photography, and, video-making ; and, belonging to the four statuts categories : student, amateur, semi-professional, and professional. This makes it possible that we use the entropy-based diversity index formula, which is as follows :

$$H= -\Sigma_{i=1,c} P_i \log (P_i)$$

Here H is the entropy-based diversity index, c quantifies how many categories there are and P_i stands for the proportion belonging to the ith category. If there is no diversity, i.e. all the participating team members have same skills or status, one proportion is one and its logged value is 0, while all the others are 0 and their logged values are also 0.

Next, to measure communication between PCM we used a dichotomous proxy of sumbissions per contest being disclosed to other participating community members. When submissions are disclosed to other participating community members, the contest organiser, in our case eYeka, allows for discussion between participating members promoting a cooperative atmosphere. Where as when submissions are kept hidden, the contest organiser promotes winning as the prime motivator and thus cultivate a climate of intense rivalry.

The Table 1, below, summarizes all our conceptual variables (including controls) and their operational measures.

Table 1 : Variables and measures

Conceptual Variables	**Operational Measures**
Contest performance	Ratio of number of accepted submission on total number of submissions

Skills diversity of contest participants	Entropy index of diversity of skills in video making, photography, animation and design of all the participants per contest
Status diversity of contest participants	Entropy index of diversity of status of all the participants per contest (as in student, amateur, semi-pro, professional)
Communication	Submissions are disclosed to other participating community members (0/1)
Number of languages	Number of languages
Brand disclosure	Client's brand name is visible during the contest(0/1)
Duration of the contest	Duration of the contest in days
Rewards	Number of rewards
Contest types	• Contest type innovation (0/1), • Contest type experience (0/1), • Contest type packaging (0/1), • Contest type communication

	platform (0/1) • Contest type user generated content (0/1)

Model Specification :

Our theory and hypotheses suggest the following model for contest performance :

Contest Performancei = $\beta 0$ + $\beta 1$Brand disclosure$i$ + $\beta 2$ Communication$i$ + $\beta 3$Nb of languages$i$ + $\beta 4$Rewards$i$ + $\beta 5$ Duration of the contest$i$ + $\beta 6$ Contest type innovation$i$ + $\beta 7$ Contest type experience$i$ + $\beta 8$ Contest type packaging$i$ + $\beta 9$ Contest type communication platform$i$ + $\beta 10$ Contest type user-generated content$i$ + $\beta 11$ Skills diversity of contest participants i + $\beta 12$ SkillsDivSquared$i$ + $\beta 13$ Status diversity of contest participants i + $\beta 14$ StatusDivSquared i + $\beta 15$ Interaction Communication SkillDiv$i$ + ε i

Results :

The following table covers the results pertaining to each hypothesis outlined previously.

Table 2 : Results

Variables	Coefficient-Significance-Standard Error • *= p<0.10 • **=p<0.05 • ***=p<0.01

Status diversity of contest participants	-.085 (.177)
StatusDivSquared	-.029 (.037)
Skills diversity of contest participants	-.252 *(.121)
SkillsDivSquared	-.685 ***(.032)
Communication	.304 *** (.074)
Interaction Communication SkillDiv	-.310 ***(.098)
Brand disclosure	-.031 (.081)
Nb of languages	-.249 ** (.077)
Rewards	.011 (.071)
Duration of the contest	-.083 (.074)
Contest type innovation	.060 (.079)
Contest type experience	.069 (.080)
Contest type packaging	026 (.073)
Contest type communication platform	-.015 (.093)

Contest type user-generated content	.078 (.098)

All our hypotheses are supported. As we can see in Table 2, that the coefficient of the squared status diversity term is non significant [-.029 (.037)], where as the squared skills diversity coefficient is significant [-.685 ***(.032)]. This supports our H1. We can also observe the two negative significant coefficients of skills diversity and squared skills diversity [-.252 *(.121); -.685 ***(.032)], which shows that there is an inverted-U shaped relationship between skills diversity of PCM and contest performance. This verifies our H2. The positive and significant coefficient of impact of communication proves our H3 [.304 *** (.074)]. The interaction term between communication and skills diversity is negative and significant [-.310 ***(.098)]. In order to better understand the impact of this interaction term we performed the simple slopes analysis, which reveals that the impact of communication is only significant during low skills diversity. The impacts of the various control variables that are considered in this study have also been reported in Table 2.

Discussion and Limitations:

We have the four theoretical contributions, which are as follows: First, we demonstrate that skills diversity differs from status diversity and that skills diversity has a more significant impact on contest performance. Second we empirically show that skills diversity has an inverted U-shaped relationship to contest performance. With this contribution we participate in the on going conversation in the open innovation search literature (Laursen and Salter, 2006) and suggest that even in the context of open

innovation contest searching widely for ideas has a curvilinear relationship with performance. Third, we demonstrate through our analysis that communication amongst PCM has a positive impact on contest performance. This suggests that allowing for communication between PCM is productive for contest performance. Fourth, our analysis reveals that skills diversity of PCM negatively moderates the relationship between communication amongst PCM and contest performance. This implies that the effects of communication amongst PCM are less positive under high diversity of PCM than under low diversity.

Our managerial contributions are as follows: First, contest managers should control for skills diversity of PCM. Searching for external actors with very diverse skills can be counter-productive for the contest. Second, Managers should in general encourage communication. However, if during a contest, managers feel that the skills diversity level of PCM is getting high then control for the communication between PCM. If on the other hand, level of skills diversity of PCM is low, higher level of communication can lead to positive impact on contest performance.

In this article we argue that though the contest structural factors are very important they are however under full control of the contest managers (Yang, Chen and Pavlou, 2010, working paper) and (s)he will do everything to reduce any inefficiency caused by these factors. Our thesis is hence that the focus should be on factors such as communication and diversity of PCM. The level of diversity of participating community members in a contest is only partially in control of contest manager. But depending on the level of diversity the communication between PCM can be manipulated to attain performing contest.

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