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## **ALL FOR THE MONEY? THE AMBIGUITY OF MONETARY REWARDS IN FIRM-INITIATED IDEATION WITH USERS**

**Christoph Ihl**

RWTH Aachen University  
Technology and Innovation Management Group  
ihl@tim.rwth-aachen.de

**Alexander Vossen**

RWTH Aachen University  
Technology and Innovation Management Group  
vossen@tim.rwth-aachen.de

**Frank Piller**

RWTH Aachen University  
Technology and Innovation Management Group  
piller@tim.rwth-aachen.de

### **Abstract**

In firm-initiated ideation with users, the hosting organization typically dominates the commercial exploitation of users' revealed ideas. In light of this asymmetric exploitation, offering monetary prizes for the best performing participants or the most valued ideas in the sense of a contest seems to be a reasonable form of compensation and incentivization. However, we question the effectiveness of monetary rewards and propose two boundary conditions where non-monetary benefits proposed in the private-collective model of user innovation (von Hippel and van Krogh; 2003, 2006) may better explain participation: (1) If users' personal involvement and need in the innovation domain is high, an

expectation of monetary rewards is deemed less important, because users expect to better internalize collective innovation outcomes and capture private benefits (non-monetary ?compensation effect?). (2) If users are supposed to allocate effort to collectively oriented activities like commenting, improving or evaluating other users? ideas, the expectation of monetary rewards is less effective, because it induces rivalry among users (?competition effect?). We find support for these hypotheses in an empirical study where user participation in a real ideation project is regressed on survey-based measures of motivating conditions that users perceived prior to the contest. We can conclude that monetary rewards can even have detrimental effects in firm-initiated ideation, if the two proposed boundary conditions are taken together.

# ALL FOR THE MONEY? THE AMBIGUITY OF MONETARY REWARDS IN FIRM-INITIATED IDEATION WITH USERS

## ABSTRACT

In firm-initiated ideation with users, the hosting organization typically dominates the commercial exploitation of users' revealed ideas. In light of this asymmetric exploitation, offering monetary prizes for the best performing participants or the most valued ideas in the sense of a contest seems to be a reasonable form of compensation and incentivization. However, we question the effectiveness of monetary rewards and propose two boundary conditions where non-monetary benefits proposed in the private-collective model of user innovation (von Hippel and van Krogh; 2003, 2006) may better explain participation: (1) If users' personal involvement and need in the innovation domain is high, an expectation of monetary rewards is deemed less important, because users expect to better internalize collective innovation outcomes and capture private benefits (non-monetary "compensation effect"). (2) If users are supposed to allocate effort to collectively oriented activities like commenting, improving or evaluating other users' ideas, the expectation of monetary rewards is less effective, because it induces rivalry among users ("competition effect"). We find support for these hypotheses in an empirical study where user participation in a real ideation project is regressed on survey-based measures of motivating conditions that users perceived prior to the contest. We can conclude that monetary rewards can even have detrimental effects in firm-initiated ideation, if the two proposed boundary conditions are taken together.

**Keywords:** User innovation, idea contests, incentives, motivation

## INTRODUCTION

New product development (NPD) is a crucial task for companies' long term success. At the very beginning, in the "fuzzy front end of innovation" (e.g. Reid and DeBrentani, 2004), NPD starts with the creation of promising ideas. For this task, practitioners have recently turned their attention on acquiring external knowledge from users and customers (Dahan and Hauser, 2002; von Hippel, 2005; Fuchs and Schreier, 2011). Idea contests (IC) are becoming increasingly popular among firms as a means to access customers' ideas (e.g. Piller and Walcher, 2006; Füller, 2010; Ebner, Leimeister and Krcmar, 2009; Bayus, 2011).

Practical examples for ICs are manifold and range from industrial to consumer goods as well as from general and abstract to concrete and specific ideation tasks. SAP AG for example invited customers to share specific ideas related to their service offering (Ebner et al., 2009). Siemens AG asked students for more general ideas on how to facilitate big cities in deserts. Dell's Idea Storm initiative is a permanent IC that constantly invites customers to share their thoughts on the service and product offering of the company on both abstract and concrete levels (Bayus, 2011).

ICs basically consist of two distinct activities for participants: (1) submitting ideas related to a specified topic, (2) evaluating, commenting and improving other participants' ideas. The former activity is typically carried out by individual users, whereas the latter is a more collectively oriented task where users interact.

Since ICs are relatively cheap and easy to implement, their number is constantly growing. This gives rise to the possibility that a seemingly infinite "crowd" of potential participants might become a scarce good in some branches of industry or themes. Since ideation in the form of crowdsourcing or peer production relies on searching many parallel paths simultaneously, a critical mass of participants is a driver of effectiveness (cf. Benkler, 2002; Howe 2008; Boudreau et al., 2011). Collaboration among users and building upon

previous contributions in the sense of collective and cumulative innovation (cf. Allen, 1983; Scotchmer, 1991) may also be desirable in firm-initiated ideation because it may further increase effectiveness by producing less redundant outcomes with improved and more elaborated quality. In consequence, we believe it is necessary to investigate in more detail what expected benefits and motivating conditions attract users to firm-initiated ideation projects and how these conditions translate into different kinds of behaviour, i.e. individually oriented idea submissions versus collectively oriented activities like evaluating, commenting and improving other users' ideas.

High participation in firm-initiated ideations seems to be challenged by hosting firms' dominated asymmetric commercial exploitation of users' revealed ideas. Hence, firms typically try to compensate and incentivize users by offering monetary and competitive rewards for the best performing users or the most valued ideas. However, we want to question the effectiveness of monetary rewards. Specifically, we ask the following questions: (1) Do monetary reward expectations always and only explain user participation when there is an asymmetric commercial exploitation of users' revealed ideas by a hosting organization? (2) Do also non-monetary benefit expectations proposed in user innovation literature explain participation in firm-initiated ideation? (3) Do boundary conditions exist that shift explanatory power from monetary to non-monetary benefit expectations; e.g. user characteristics or different kinds of participation behaviour?

In order to theoretically guide our investigation of these research questions, we conceive firm-initiated ideation with users as an instance of private-collective user innovation (von Hippel and van Krogh; 2003, 2006) that deviates in the fact that one commercial entity predominantly governs the exploitation of users' revealed ideas. To answer these questions empirically, we seek to explain participation behaviour from a real ideation project at a large German university. All invited users were surveyed on their expected benefits and motivation

conditions *prior* to ideation, in contrast to ex-post measurement of motivations in previous studies (e.g. Piller and Walcher, 2006; Füller, 2010; Ebner et al., 2009). We hope to maximize the possibilities for causal inference with this approach because it should minimize the threat of selection bias that might be caused by the exclusion of non-participants and it should rule out the opportunity for respondents to rationalize their answers ex-post in a socially desirable way.

In our results, we find support for two hypothesized boundary conditions where expected monetary rewards are less effective and non-monetary benefits proposed in the private-collective innovation model better explain participation behaviour: (1) If users' personal involvement and need in the innovation domain is high, then users expect to better internalize the collective innovation outcome and capture private benefits from it, so that a compensation through monetary rewards is deemed to be less important. (2) The expectation of monetary rewards may induce competition among users and thereby reduce the amount of effort that users allocate to collectively oriented activities like commenting, improving or evaluating other users' ideas.

In our opinion, the theoretical contribution of this study lies in a more fine-grained explanation of user innovation behaviour in "hybrid innovation settings" (Harhoff and Mayrhofer, 2010) where dominant entities with commercial interests interact with communities of innovating users. Our explanation is based on a reconciliation of the behavioural economics and psychology literature on the boundaries of monetary and competitive reward structures in fostering public good provisions as well as cooperative and pro-social behaviour (e.g. Tjosvold 1982, 1985; Frey and Oberholzer-Gee, F., 1997; Vohs et al., 2006) with the non-monetary motivating conditions put forward in the user innovation literature and specifically in the private-collective action model by von Hippel and van Krogh (2003; 2006).

In terms of managerial contribution, we hope to shed light on an important trade-off that practitioners should consider when implementing ideation projects with customers: Besides raising the number of ideas submitted, offering monetary rewards may nevertheless erode collectively oriented participation and may be less effective in attracting users with extensive personal involvement and needs – a characteristic often associated with most innovative “lead users” (cf. Franke et al., 2006).

## **THEORETICAL BACKGROUND**

### **User innovation and the private-collective innovation model**

In order to theoretically guide our investigation of these research questions, we conceive firm-initiated ideation with users as an instance of user innovation and, more specifically, as an instance of private-collective user innovation (von Hippel and van Krogh; 2003, 2006). Research has extensively dealt with the question, why users become innovative as individuals (see O’Hern and Rindfleisch, 2010; Bogers, Afuah and Bastian, 2010 for recent reviews). Von Hippel (1976; 1986) was among the first to discover unmet personal needs as the dominant driver of autonomous innovation by users. Users’ strongest motivation to engage in innovative activities results from the desire to get one’s own problem solved and not from the desire of earning money (von Hippel, 2005). Instead of selling their innovations like manufacturers do, users benefit from using their self-developed products. Innovating users have been found in the industrial goods sector (von Hippel, 1986) as well as the consumer goods sector (e.g. Franke and Shah, 2003). Accordingly, unsatisfied personal needs and the desire or expectation to fulfil them have been identified as one key characteristic of a very important and innovative group of users: so called lead users (Urban and von Hippel, 1986; Herstatt and von Hippel, 1992; Schreier and Pruegl, 2008).

In addition to innovating, users have also been shown to freely reveal their innovations to other firms or the public (von Hippel, 2005). Creating these externalities may seem to be irrational at first glance, but can quite well be explained by a utility maximizing rationale as users can expect further diffusion and improvement of their innovation by other users and firms (Harhoff et al., 2003). Users do not even abstain from innovating in collective settings where they have to expect externalities beyond their control. These collective or community settings of simultaneously and jointly innovating users arise even more often due to advances in information and communication technology and the rise of the internet (von Hippel, 2005). The most prominent example of this form is Open Source Software development (OSS), where many users unite and create a complex, but freely available software program (Lakhani and von Hippel, 2003).

Studying OSS, von Hippel and von Krogh (2003; 2006) observed that the two predominant traditional models of “private investment” and “collective action” are insufficient. The private model assumes that market actors innovate by investing their own resources and appropriate rents from this investment, either through intellectual property right or direct monetary compensation. However, in OSS users invest private resources, but there are no rights or compensations in exchange. In contrast, the collective action model seeks to explain the provision of public goods that typically are non-excludable and non-rival, thus in danger of excessive free-riding. According to the collective action model, these public goods nevertheless come to existence due to careful recruiting of participants as well as encouraging and motivating contributions over free-riding. However, in OSS there are no efforts in carefully recruiting because masses of users self-select their contributions, but also to free-ride at any time and piece of code (cf. von Hippel and von Krogh 2003).

Accordingly, von Hippel and von Krogh (2003) propose a private-collective innovation model that deviates from the private investment model in that users, as opposed to selling

manufacturers, do not necessarily expect a *monetary reward* in return for their innovations. This may be due to low competition among users or low expected profits from selling their innovations. This is in line with the previous arguments in favour of innovating users.

On the other hand, the private-collective innovation model also deviates from collective action in that freely revealed user innovations are not always perfectly public such that free-riders can benefit from them to the same extent. Private benefits can even stem from largely collective *innovation outcomes* if users are able to better adapt the outcome to their private and own *personal needs*. This influence can only happen by the means of their own participation and contribution. In consequence, the collective innovation outcome may nevertheless add more extensively or even uniquely to revealing and contributing users rather than free-riders. In addition to the benefits that stem from expected private captures of the innovation outcomes, there are other potential benefits that may uniquely accrue to contributors rather than free-riders, i.e. *reputational gains* or *intrinsic enjoyment* from being innovative (e.g. Lakhani and Wolf, 2005).

Along the lines of the private-collective innovation model, we argue that firm-initiated ideation with a user community is a collective innovation setting where user contributions are subject to externalities. That users nevertheless contribute is also due to expected non-monetary benefits which accrue to participants rather than free-riders. In particular, users benefit *to a larger extent* from the collective *innovation outcome* as free-riders even though the latter may formally have the same access. This is because users can more extensively adapt the innovation outcome according to their personal need by the means of their own participation and hence capture a larger, more customized stake of the innovation outcome. Compared to free-riders, users may even *uniquely* benefit from their participation in terms of *reputational gains* or *intrinsic enjoyment*. In line with the user innovation logic, we would expect that the extent of these private benefits users expect to capture from participation

positively depends on their involvement and especially their unsatisfied personal needs in the innovation domain. This leads to our first hypothesis:

*H1: The influence of expected non-monetary benefits (innovation outcome, enjoyment, reputation) on user participation in firm-initiated ideation is larger for users with high personal needs.*

### **The (ambiguous) role of monetary rewards**

Private appropriation through monetary incentives seems to play a minor role for user innovation, especially when other users are likely to develop similar ideas and innovations, or when the expected profits from private appropriation are low (von Hippel and von Krogh, 2006). These conditions seem to apply in ideation tasks as opposed to technical problem solving tasks (cf. Terwiesch and Xu 2008). Submissions to firm-initiated ideation projects typically tend to have a low specificity and degree of elaboration (Piller and Walcher, 2006). Therefore, monetary incentives may not be necessary.

The question is whether this also holds true in firm-initiated ideation, where one predominant entity (the hosting firm) governs the exploitation of the innovation output, as opposed to settings where this is done by users collectively. Harhoff and Mayrhofer (2010, p.173) describe such settings as “hybrid innovation forms” where “one entity systematically and repeatedly capitalizes commercially on freely revealed innovations generated by a user community”. User participation in hybrid settings may be challenged by an asymmetric commercial exploitation of users’ revealed ideas. Therefore, Harhoff and Mayrhofer (2010) highlight the role of perceived fairness, mostly in terms of a fair distribution of outcome, in order to sustain stable conditions. Accordingly, firms typically try to compensate and

incentivize users by offering monetary and competitive rewards for the best performing users or the most valued ideas. However, we propose to qualify the effectiveness of monetary rewards with the above insights from the user innovation phenomenon which grounds in users unmet needs and their desire to get own problems solved (von Hippel, 2005). If users' personal involvement and need in the innovation domain is high, an expectation of monetary rewards is deemed less important, because users can expect to internalize collective innovation outcomes to a larger extent and capture private benefits. We therefore hypothesize a “non-monetary compensation effect”:

*H2: The influence of expected monetary rewards on user participation in firm-initiated ideation is smaller for users with high personal needs.*

Notwithstanding the general effectiveness of (high enough) monetary rewards to compensate for effort (Gneezy and Rustichini, 2000), prior research in behavioural economics and psychology has produced quite useful insights into the boundaries of monetary rewards for diverse tasks and settings. On this basis, we seek to further qualify the effectiveness of monetary rewards also in firm-initiated ideation. Specifically, we examine the effect of monetary incentives based upon three streams of literature that relate to central aspects of firm-initiated ideation: (1) rewards and creativity, since users are supposed to generate novel ideas, (2) competitive reward structure in the form of tournaments, since users are also likely to compete against each other to win the contest, and (3) rewards and pro-social behaviour, since users are supposed to collectively contribute to a common innovation outcome.

Creativity is strongly believed to stem from high levels of intrinsic motivation (e.g. Burroughs et al. 2011; Amabile et al. 1996). Many authors have highlighted the negative impact of monetary incentives in terms of crowding out intrinsic motivation (e.g. Ryan and

Deci, 2000; Eisenberger and Shannock, 2003; Deci, Koester and Ryan, 1999). However, Borroughs et al. (2011) find that, with specific creativity training, the negative effect of monetary rewards on intrinsic creativity actually turns positive. And for ideation tasks, Toubia (2006) found that properly designed incentive structures can have a very positive effect on the outcome of an ideation session. In addition, Piller and Walcher (2006) found that users often have developed their ideas in advance and have these in their minds already when coming to an ideation contest to just share it. As such, monetary rewards have limited potential to disturb the creative focus of participants.

The literature on tournaments in general has pointed out that a competitive reward structure can lead to very efficient outcomes (e.g. Lazear and Rosen 1981; Pendergast 1999). Especially in firm-initiated ideation they have been shown to be a major motivator for participants to exert effort (Piller and Walcher, 2006; Füller, 2010). However, this effort is likely to be focused on individually orientated behaviour of submitting ideas as a dominant strategy to increase the likelihood of winning the competition. Studies have shown that next to positive effects, a competitive incentive can lower to the trust between individuals (Ferrin and Dirks 2003), can crowd out voluntary cooperation between individuals (Irlenbusch and Ruchala 2008), and can even lead to intentional malicious behaviour such as sabotage (Harbring and Irlenbusch 2008). Hence, inducing a tournament style competition among participants may indeed lead to a higher individual performance, but in turn may decrease collective action.

This assertion also finds support in the literature on rewards and pro-social behaviour and the provision to public goods. When people are supposed to engage in social activities, offering monetary incentive may have negative consequences, since it undermines the pro-social motivation to perform that task (e.g. Bénabou and Tirole 2006; Ariely et al. 2009). As Benabou and Tirole (2006) highlight, “rewards [...] create doubt about the true motive for

which good deeds are performed, and this "over justification effect" can induce a partial or even net crowding out of pro-social behaviour by extrinsic rewards" (p.1652). Ariely et al. (2009) show that the mere presence of monetary incentives makes people think about how others perceive their behaviour - as "doing good or doing well". Heyman and Ariely (2004) show that the effectiveness of monetary incentives relies on the setting in which they are offered: in social markets, where exchange is based on social norms, their effect is negative, whereas in money markets, where exchange is based upon economic principles, monetary incentives have a positive effect. In firm-initiated ideation, these two settings could be associated with user-to-user and user-to-firm relationships, respectively.

All in all, monetary rewards can induce fiercer competition. The expectation of high levels of competition among users may in turn impede high levels of participation (Boudreau et al., 2011). At least we propose a "competition effect" in the sense that expectation of monetary rewards may incentivize users to focus on their own ideas at the expense of their collective orientation of helping fellow participants. This speaks in favour of monetary rewards when it comes to individually orientated effort of idea submissions, but against monetary rewards when it comes to collectively oriented effort of commenting, evaluating, and improving other users' ideas. Rather than in absolute terms, we prefer to formulate the corresponding hypotheses about the different effects of expected monetary rewards on individually and collectively oriented behaviour in relation to non-monetary benefits:

*H3a: The influence of expected monetary rewards on users' individually oriented participation to submit an idea is larger than the effects of expected non-monetary benefits (innovation outcome, enjoyment, reputation).*

*H3b: The influence of expected monetary rewards on users' collectively oriented participation is smaller than the effects of the expected non-monetary benefits (innovation outcome, enjoyment, reputation).*

The following figure summarizes the research framework for the empirical work of this study.

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## **DATA AND MEASURES**

In order to test our hypotheses, we collected data in two stages. The first aimed at measuring motivating conditions and expected benefits from participation, while the second is used to gather behaviour data. The first stage consisted of a survey among students at a major German university to investigate their intention to participate in a hypothetical IC on improving student services and study infrastructure at this university. The sample consists of a total of 1015 students over 20 different fields of study that all attended the class on “introduction into business administration”. All students received a personalized invitation link for the online survey. No formal incentives or credit was awarded for participation in the survey. Overall, the survey had 585 (57.64%) participants of which 470 (46.31%) completed the survey, which can be considered as good. 32.8% of the participants were female and 67.2% male which is representative for the university’s student population. The mean age was about 21.89 years. Gender, age, and the time enrolled at the university were used as controls for the model.

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*Insert Figure 2 here*  
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The research setting is designed in the way that is possible to capture “real” intentions, expectations and motivations since the participants were asked for their intention and attitudes towards participation for a hypothetical upcoming contest. The questionnaire invitations were sent online and answered ahead (four weeks) of the real contest. Upon completion of the questionnaire, participants were informed that the real contest will take place.

For measuring our constructs, we build on existing scales, which we slightly modified for our purpose. Reputation, enjoyment and monetary reward expectations were derived and adapted from OSS literature (Hars and Ou 2002; Roberts et al. 2006). We measured personal need with scales adapted from Franke, von Hippel and Schreier (2006). The innovative outcome scale was adapted from Zirger and Maidique (1990) as well as Dellaert and Dabholkar (2009). All motivational constructs were measured via multiple items on a five point likert scale anchored with “I totally disagree” and “I totally agree”. A more detailed table of all constructs and items can be found in the appendix.

In the pursuit of validating the measures, we first conducted exploratory factor and reliability analyses. From all constructs, the intended factors could be extracted. Next, we conducted a confirmatory factor analysis with all model constructs. Overall, the CFA model showed an excellent fit ( $\chi^2=118.36$ ,  $df=80$ ,  $\chi^2/df= 1.478$ ), root mean square error of approximation [RMSEA]=0.032, non-normed fit index [NNFI]=0.981, and comparative fit index [CFI]= 0.986).

In order to prove our assumptions about the effect on behaviour, in Study 2, an actual IC with the topic “What services or products could the university offer to improve your study conditions?” was conducted. In order to achieve a certain amount of generalizability of the result, an IC design was chosen that is common in real world application. Following a similar rewarding approach as Toubia (2006), we monetarily incentivized posting ideas, as well as overall effort. We used six Amazon coupons for monetary incentives, three for the best ideas

(300/ 200/ 100 euros) and in order to incentivize other activities also three for the best supporters (50 euros each), meaning participants with the most comments and evaluations. For being capable of combining the survey data and the behaviour data from the contests, the same 1015 students used in Study 1 were incorporated into the analysis. 241 people from this sample logged into the contest at least once. From these, 79 users did not participate in the survey and hence were excluded from the analysis. This leads to a total of 162 valid participants. The average age of the valid participants was 21,74 years. 72,84% of the participants were male and 27,16% female, which is comparable to the ratio of Study 1.

For measuring individual idea generation behaviour, we build a binary variable that states if a participant has posted an idea in the IC or not. The variable was labelled ID\_YN. In order to capture the collective participation effort, a behavioural count variable was build. The variable included all activities that relate to the collectively orientated, supportive functionalities of the contest tool. This includes all comments made and all evaluations given and therefore was labelled ACT\_CE.

## **ECONOMETRIC APPROACH**

We used two types of regression in our analysis: a binary probit model (cf. Aldrich and Nelson, 1984;) for individually oriented participation, which is measured by a binary observed indicator of submitting at least one idea or not; a zero-inflated negative binomial model (cf. Lambert, 1992) for collectively oriented participation, which is measured by a count variable of the number of evaluations, improvements and comments given to other users. Specifically, we model the unobserved propensity of user  $i$  to engage in individually oriented participation,  $IP_i^*$ , such that:

$$IP_i^* = \alpha_l + \beta_l' \mathbf{BENEFIT}_i + \gamma_l' (\mathbf{NEED}_i * \mathbf{BENEFIT}_i) + \delta_l' \mathbf{CONTR}_i + \varepsilon_{l,i} = \mathbf{B}_l' \mathbf{X}_i + \varepsilon_{l,i}$$

where  $\alpha_I$  is a constant,  $\mathbf{BENEFIT}_i$  is a vector of expected benefits of user  $i$  with a corresponding coefficient vector  $\boldsymbol{\beta}'_I$ ,  $(NEED_i * \mathbf{BENEFIT}_i)$  is the vector of expected benefits interacted or multiplied with the individual-specific moderator variable  $NEED_i$  entering with the corresponding coefficient vector  $\boldsymbol{\gamma}'_I$ , and  $\mathbf{CONTR}_i$  is the vector of individual-specific control variables including the moderator variable  $NEED_i$  and  $\boldsymbol{\delta}'_I$  is the corresponding coefficient vector. We assume that  $\varepsilon_{I,i}$  is normally distributed so that the probit probability of user  $i$  to submit an idea is given by  $P(IP_i = 1) = \Phi(\mathbf{B}'_I \mathbf{X}_i)$  with  $\Phi(\cdot)$  being the cumulative normal distribution function.

We assume that the unobserved propensity of user  $i$  to engage in collectively oriented participation,  $CP_i^*$ , is only partially observed together with her decision to participate in (this) firm-initiated ideation at all. That is, the observed number of collectively oriented participation of user  $i$ ,  $CP_i$ , is generated by the process

$$CP_i = z_i * CP_i^*$$

where  $z_i$  is a binary variable indicating the participation of user  $i$  in firm-initiated participation. Hence, the probability for zero collectively oriented actions,  $P(CP_i = 0)$ , can arise through two processes, i.e. the probability of deciding against participation in firm-initiated ideation or the probability of zero collectively oriented actions conditional on participation:

$$P(CP_i = 0) = P(z_i = 0) + (1 - P(z_i = 0)) * f(CP_i^* = 0)$$

The probability for  $k$  collectively oriented actions,  $P(CP_i = k)$ , in turn is given by:

$$P(CP_i = k) = (1 - P(z_i = 0)) * f(CP_i^* = k)$$

Let  $f(CP_i^* = k)$  denote probability density function for the counts of collectively oriented actions. We parameterize the conditional mean of this function,  $\lambda_i$ , by the same explanatory variables as above with a new coefficient vector plus latent heterogeneity,  $\varepsilon_{C,i}$ :

$$\lambda_i = \exp(\alpha_c + \beta'_c \mathbf{BENEFIT}_i + \gamma'_c (\mathbf{NEED}_i * \mathbf{BENEFIT}_i) + \delta'_c \mathbf{CONTR}_i + \varepsilon_{c,i})$$

$$\lambda_i = \exp(\mathbf{B}'_c \mathbf{X}_i + \varepsilon_{c,i}) = \exp(\mathbf{B}'_c \mathbf{X}_i) * \exp(\varepsilon_{c,i})$$

If we assume that  $\exp(\varepsilon_{c,i})$  follows a Gamma distribution with a mean of 1 and a variance of  $\alpha$ , we can obtain a negative binomial distribution for the counts of collectively oriented actions after integrating  $\exp(\varepsilon_{c,i})$  out. This distribution has a mean of  $\exp(\mathbf{B}'_c \mathbf{X}_i)$ , but allows for overdispersion in the variance.

Let  $P(z_i = 0)$  denote a cumulative logistic probability function for the probability (not) to take part in firm-initiated ideation at all. We parameterize this probability by the same linear index of explanatory variables and coefficients as in the negative binomial part,  $\mathbf{B}'_c \mathbf{X}_i$ , however, we scale it by a parameter,  $\tau$ :

$$P(z_i = 0) = \frac{\exp(\tau \mathbf{B}'_c \mathbf{X}_i)}{1 + \exp(\tau \mathbf{B}'_c \mathbf{X}_i)}$$

We chose this parsimonious parameterization (cf. Lambert, 1992; Greene, 1994) because we did not formulate dedicated hypotheses about the relationship between  $P(z_i = 0)$  and the expected number of collectively oriented action,  $\lambda_i$ . The conditional expected mean function for this zero-inflated negative binomial model is given by:

$$E(CP_i | \mathbf{B}_c, \mathbf{X}_i, \tau) = \left(1 - \frac{\exp(\tau \mathbf{B}'_c \mathbf{X}_i)}{1 + \exp(\tau \mathbf{B}'_c \mathbf{X}_i)}\right) * \exp(\mathbf{B}'_c \mathbf{X}_i) = \frac{\exp(\mathbf{B}'_c \mathbf{X}_i)}{1 + \exp(\tau \mathbf{B}'_c \mathbf{X}_i)}$$

To check the appropriateness of this model specification we followed the recommendations by Chin and Qudus (2003): zero inflation was assessed by means of the Vuong statistic (1989) which attained a value of 2.329 in our sample and thus pointing to a significant zero inflation. Furthermore, the overdispersion parameter  $\alpha$  was found highly significant in Model 4 of Table 1 with a parameter value of 9.640 and a standard error of 0.420.

There has been a recent debate about the interpretability of effects based on coefficients in non-linear models, especially if variables appear more than once in interaction terms or models with more than one regression equation like in our case (cf. Ai and Norton, 2003; Hoetker, 2007, Greene, 2010). Ai and Norton (2003) argue that interpreting the effects of interacted variables or interaction terms in terms of significance and sign is impossible based on coefficients alone or even based on marginal effects if they do not take into account that involved variables appear in both main *and* an interaction terms. Hence, Ai and Norton (2003) suggest using appropriate partial and cross-partial derivatives to obtain these effects.

Notwithstanding the correctness of this procedure, Greene (2010) questions whether hypothesis testing should happen at the level of (cross-) partial or marginal effects at all, since these effects are a function of all data and all coefficients including the less meaningful constants. He argues for supplementing the interpretation of interaction effects by meaningful plots in post-estimation analysis, but leaving hypothesis testing to the estimation stage. Recently, Bowen (2010) argued that a significant coefficient of an interaction term is sufficient for the existence of an interaction effect, but its sign has to be qualified by a “secondary” interaction effect, which subtracts the effect of mere functional non-linearity from the total interaction effect put forward by Ai and Norton (2003).

In conclusion for our study, we obtained the partial derivatives of the respective conditional mean functions (probit and zero-inflated negative binomial) with respect to the expected benefits as well as the cross-partial derivatives with respect to the moderator personal need in such a way that recognizes non-linearity and all interaction terms. The cross-partial effects were obtained for both models with and without interaction terms in order to also calculate secondary interaction effects net of any mere non-linearity effects. The formulas for these partial and cross-partial effects are shown in Appendix B. These effects were then calculated for each individual respondent and then averaged to arrive at average

marginal main and interaction effects. This procedure is supposed to be the preferred compared to calculations at certain data points like sample means. The significance of these effects was assessed using the Delta method (Greene, 2000), in order to supplement our hypotheses tests via coefficients. In addition the values of the average marginal main effects of expected benefits were plotted over the range of the moderator variable personal need in order to visualize the effect size of the moderation.

**RESULTS**

Concerning the probit models (Model 1 & 2), we find that the sole influence having a significant impact on idea generation behaviour is the monetary reward expectation, while the expectancy of non-monetary rewards like enjoyment, reputational gains or the expectancy of an innovative outcome does not have a significant effect. Analysing the interaction effects shows that monetary reward expectation is negatively moderated by personal need, while the non-monetary ones like enjoyment and innovative outcome expectation are positively moderated.

For the count models (Model 3 & 4), we find that the non-monetary innovative outcome expectation is the only driver of collectively orientated behaviour. Again, most personal need related interaction terms show significant effects. While this is positive for the non-monetary reward expectations enjoyment and innovative outcome, it is negative for monetary reward expectations. Hence, we find first indication of support for our hypotheses H1 and H2.

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*Insert Table 1 here*  
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Analysing the plots of the average marginal effects (AME) yields interesting results, which are partially opposing to the results derived from the sole interpretation of the marginal effect. For the probit models, the AME of expected monetary reward is positive for all values of personal need and significant for all values besides the highest ones. Consequently, monetary reward expectations have a positive impact on the probability to submit an idea.

For non-monetary rewards the AME plots show that the impact on the probability to submit an idea is negative for low values of personal need, while it is positive for high values of personal need, although only marginally significant.

Analysing the AME plot of the difference between monetary and non-monetary reward expectations shows that indeed the effect of monetary reward expectations on idea generation behaviour is indeed stronger than the sum of the non-monetary ones. This confirms hypotheses H3a. In addition, it shows that the effect is weaker for participants with high personal need, which fortifies H1.

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*Insert Figure 3 about here*

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For the count models, the results are similar. The AME plots show that the expected monetary reward has a marginally significant positive impact for participants with very low personal needs, while this effect is significantly negative for participants with high levels of personal needs.

Similar aspects count for the role of non-monetary reward expectations. Their effect on collective orientated participation is significantly negative for participants with low personal needs, but positive for participants with high personal needs. Finally, the AME plot of the

difference between monetary and non-monetary reward expectations shows that while the effect of monetary reward expectations is significantly stronger for participants with low personal needs and it is significantly weaker than the non-monetary reward expectations for participants with strong personal needs. This confirms H2 and H3b. A detailed list of all AME calculation results can be found in Table 2 within the appendix.

## **DISCUSSION & IMPLICATIONS**

With this study, we aimed at answering the following questions: (1) Can monetary reward expectations explain user participation in firm-initiated ideation when there is an asymmetric commercial exploitation of users' revealed ideas by a hosting organization? (2) Can non-monetary benefit expectations proposed in user innovation literature also explain participation in firm-initiated ideation? (3) Do boundary conditions exist that shift explanatory power from monetary to non-monetary benefit expectations, e.g. user characteristics or different kinds of participation behaviour?

Concerning the first question and the role of monetary rewards, we find that expected monetary reward is on average the sole driver of the likelihood to submit an idea for average users. Hence, firm-initiated ideation deviates from UI/OSS models such as the private-collective innovation model in this regard. A predominant entity that governs ideation (in this case the firm) needs to introduce a monetary reward in order to induce users to reveal their ideas. While creativity theory would speak against the importance of monetary rewards and for the importance of intrinsic enjoyment, we find the opposite to some degree. Hence, idea submission seems to be seen as a creative task only by those users, who perceive to solve their own current problems. The average user, however, seems to have ideas ready at hand without much creativity involved.

On the other hand, expected monetary reward does on average not seem to induce collectively oriented participation behaviour, which fortifies our assumption that monetary incentives foster competition and hence lower incentives to do collectively orientated participation. This is even underlined in our study setting, since in this specific ideation project commenting, improving or evaluating other users' ideas was also incentivized by monetary rewards.

Concerning the role of non-monetary reward expectations, we find those expectations proposed by UI/OSS are not capable of explaining users' participation behaviour in general. While they have no impact on the idea generation behaviour, it affects the collective orientated participation, but only in terms of the innovative outcome expectations.

However, non-monetary UI/OSS expectations are capable of explaining the participation behaviour for participants with strong personal needs. Hence, personal need provide a boundary condition that empowers the role of the non-monetary reward expectations and attenuates the effect of monetary rewards. When experiencing a strong personal need, participants benefit from non-monetary benefits such as enjoyment (for idea generation behaviour) and peer recognition (for collectively orientated participation). This is in line with our assumptions, as well as with prior OSS related research.

This effect holds for both kinds of behaviour. For the idea sharing behaviour, the importance of monetary rewards is less strong for users who have a strong personal need and hence interest in the innovation outcome. Those users with strong personal needs seem also to expect some intrinsic enjoyment when articulating their ideas.

For the collectively oriented participation behaviour, both non-monetary users' interest in the innovation outcome and personal needs are of utter relevance. In addition, for users with strong personal needs monetary rewards even seem to be detrimental for collectively

oriented participation. Given another strong interaction effect, the importance of the users' expected innovation outcome is even stronger, when they also perceive strong personal needs. This implies that collectively oriented participation is partly driven by users' motive to adapt the innovation outcome to their personal needs, as proposed by user innovation theory and the private-collective innovation model. This aspect is further fortified by the results from the comparison of the difference between monetary and non-monetary rewards.

A secondary driver of collectively oriented participation especially important for users with strong personal needs is reputational gain. This is an interesting fact, since UI/OSS and firm-initiated ideation deviate in terms of the time horizon. Many studies on OSS (and related fields such as online forums) relate the positive effect on the long term character. But even in relatively short term activities like firm-initiated ideation, people are willing to invest more effort due to expectancy of recognition from other participants. We do not find that intrinsic enjoyment plays a role in collectively oriented participation, however.

Concerning our main research objective, we can conclude that we found significant differences in patterns of motivation in idea generation that address different behavioural aspects. By examining the probability to submit an idea as well as the collective orientated effort, we intended to cover two different kinds of participation. Both aspects are important to consider when companies deal with the question how to design their firm-initiated ideation activities. We find that both monetary and non-monetary expectations play an important role in explaining users' and customers' participation behaviour. Surprisingly, none of the motives we analysed is capable of explaining both kinds of behaviour.

The results seem to fortify our assumptions of monetary rewards as compensates rather than incentive. People are only willing to post an idea, if they get compensated for doing so properly and personally. However, if participants believe that their participation has an impact

and that they can contribute to an innovative outcome, they are willing to invest much more collectively orientated effort, helping other participants.

Concerning theoretical implications of this paper, these results, which are comparable to Toubia (2006), give another example of a positive effect of monetary rewards on idea generation behaviour of customers. In addition, we showed evidence for different patterns of motivation on different kinds of innovative behaviour. Despite its origins in OSS, which usually has a long term character, we also proved evidence for the influence of collective benefit believes, in terms of innovative outcome expectations and reputational effects, in short term settings.

Further, we gave a first empirical explanation of users' innovative behaviour in "hybrid innovation" (Harhoff and Mayrhofer 2010); i.e. settings where entities with commercial interests asymmetrically exploit the output of innovative user communities. Hence, we showed that customers are also willing to contribute to an innovative outcome, when the possibility to improve it is rather short and even when the exploitation is governed by a dominant host. In addition, we proved empirical evidence and contributed to literature by showing boundaries of monetary and competitive reward structures in ideation and innovation settings and highlighted their ambiguous role.

Our results have implications for the design of firm-initiated ideation as well as for the recruitment of participants. Firms seem to face a trade-off when introducing performance-based monetary rewards in a contest like fashion. While monetary rewards are likely to increase the number of submitted ideas, they may also reduce users' collectively oriented effort of commenting, improving and evaluating other ideas. This trade-off may be very worthwhile to consider as not sheer idea generation, but also their improvement, consolidation and filtering are important for an effective ideation process. In order to encourage a more cumulative process of ideation with users, firms perhaps need to consider more complex

monetary incentives schemes than simply offering separate monetary rewards for collectively oriented participation (cf. Toubia 2006).

Our results indicate that this trade-off may also be alleviated by recruiting participants with high personal needs, e.g. by the use of certain invitation framings that emphasize users' opportunity to articulate their personal needs. For users with high personal needs, both idea submission and collectively oriented participation is less contingent on monetary rewards and more heavily based on their expectation of useful innovation outcomes. Furthermore, firms can choose and frame an ideation theme in a way that makes collective interest in the innovation outcome more salient, as our results show that this interest evokes more altruistic and collectively oriented behaviour.

We can conclude that organizations that intend to use firm-initiated ideation have to take the monetary as well as non-monetary motives into account. Setting up a prize may incentivize people to post or generate more ideas, but it does not enhance the overall effort of participation. If organizations are interested more in frequent discussions and interactions between customers, they should consider fostering the innovative outcome of participation (e.g. by emphasizing on willingness to change the status quo). This becomes even more important when companies aim at addressing highly dissatisfied customers in order to benefit from their high innovative potential.

## **LIMITATIONS & OUTLOOK**

Of course, the results generated in this study have some limitations and implications for future research. First, we only measured quantitative behaviour, meaning that we can answer questions about how much effort participants invested or if participants contributed an idea, but we cannot decide how useful participation was. With our approach, we therefore cannot differ the quality of participation among participants, exploring e.g. if higher private benefits

lead to better quality ideas. Indeed, we did measure the quality of ideas generated by letting three independent judges evaluate them, but we were not able to find significant results for the impact of motives on idea quality, although the quality indicators of this evaluation were sufficiently high ( $\alpha$  of the judges  $A_1: .82$ ;  $A_2: .695$ ;  $A_3: .851$ ; interclass correlation coefficient (ICC):  $.071$ ). Further research is needed that addresses this issue, providing insights on what type of motivation evokes desirable or good behaviour in firm-initiated ideation.

Secondly, the research setting could bear some limitations, since the scenario was university based, although prior research has shown that companies, like in the case of Siemens AG mentioned in the introduction, often specifically address students as a target group. The main limitation of this study, however, is that it covers only one ideation project and, more importantly, one kind of sponsor that is in our case a public university. Findings may not necessarily generalize to other sponsors in the sense that sponsor type could moderate the importance of certain motives and incentives (see e.g. Aaker, Vohs and Mogilner, 2009). With for-profit sponsors, monetary rewards perhaps induce an even more competitive nature and sharper trade-off between individually and collectively oriented participation, while the interest in the collective innovation outcome may be less important. Instead of pure correlational approaches, future research should manipulate the salience of monetary rewards, personal needs and collective innovation interest via factors like incentive schemes, type of sponsor and ideation domain in (field) experiments to more rigorously show their effect on different facets of participation.

Similar limitations arise from the method itself. Though we did our best to use a common setting for the IC, there are maybe important design aspects that had to be left out. It could e.g. be interesting to see whether results differ for different types of hosts. Related to this, it could be valuable to see whether certain design aspects of ICs, like who selects the winners (a jury or the participants themselves) has an impact on participants fairness

perceptions or acts similar to an empowerment strategy (e.g. Fuchs and Schreier, 2011). Similar aspects could be relevant, when having a closer look at the ideation task itself, in order to verify if a broad and unspecific topic is more beneficial than a possible more creative constrained task (e.g. Moreau and Dahl, 2005). On the other hand, participants do not have the choice to choose the topic on which they want to work, which could lower their overall intrinsic motivation (Iyengar and Lepper, 1999). It would be useful to examine, whether any of such factors evokes certain kinds of behaviour and if by changing these factors, organisations can direct participants' behaviour in the contest.

Another limitation arises from the fact that due to our method of data collection, we cannot decide whether participants generated an idea or just shared the idea. As stated in the hypotheses development part, we cannot say for sure if any idea posted on the IC was generated just for this contest, or if it was generated ahead. This issue is caused by our “real-world” setting, which includes an online participation. Examining this effect more in detail would require a more controlled data collection, like for example in a laboratory experimental setting. Another promising way of future research could deal with disentangling the collective benefit perceptions, measuring to what extent it consists of self-benefits and others' benefits (e.g. White and Peloza, 2009). It could be interesting to see if the effect on behaviour (quantitative or qualitative) differs for tasks that are intended to generate benefits for others, like for example pro-social tasks.

Finally, future research could address differences between groups of participants more in detail. By incorporating the moderating role of personal need, we provided a first distinction parameter. Future work could address other personal traits that influence innovative behaviour, like for example use experience or personal innovativeness (Schreier and Prüggl, 2008).

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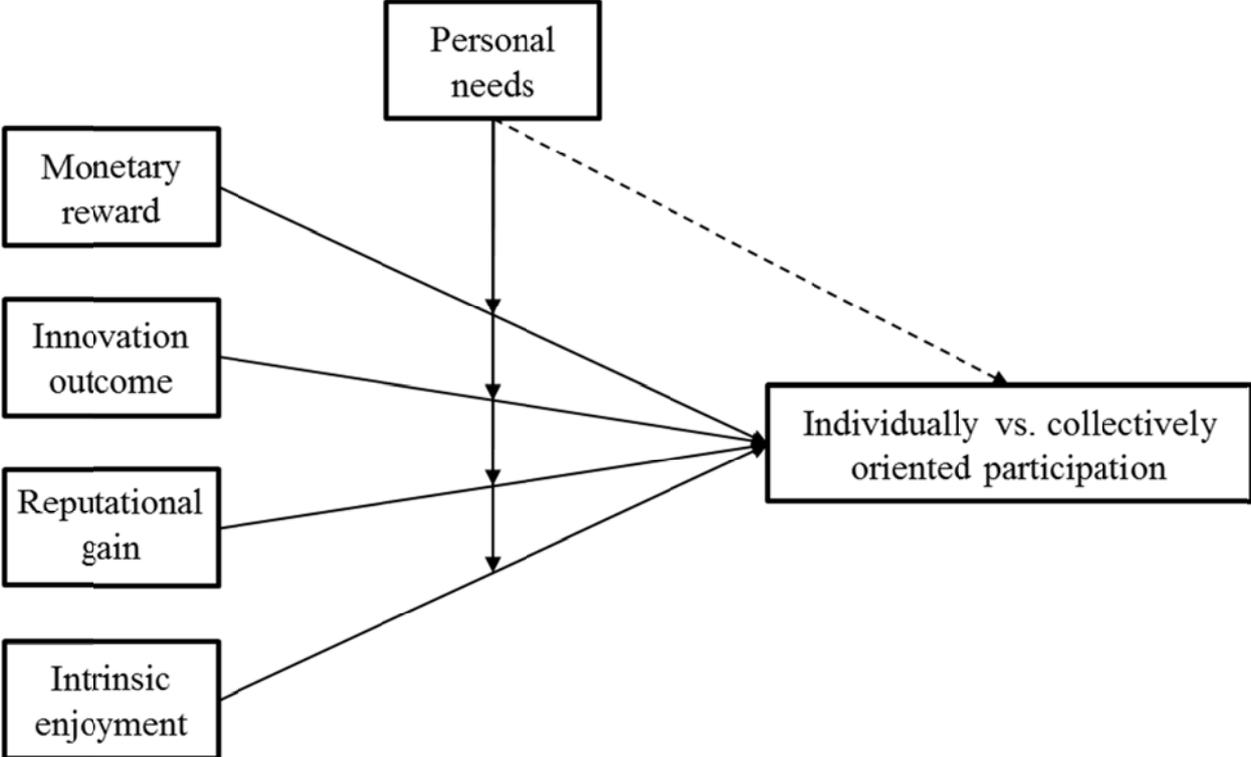
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**FIGURES**

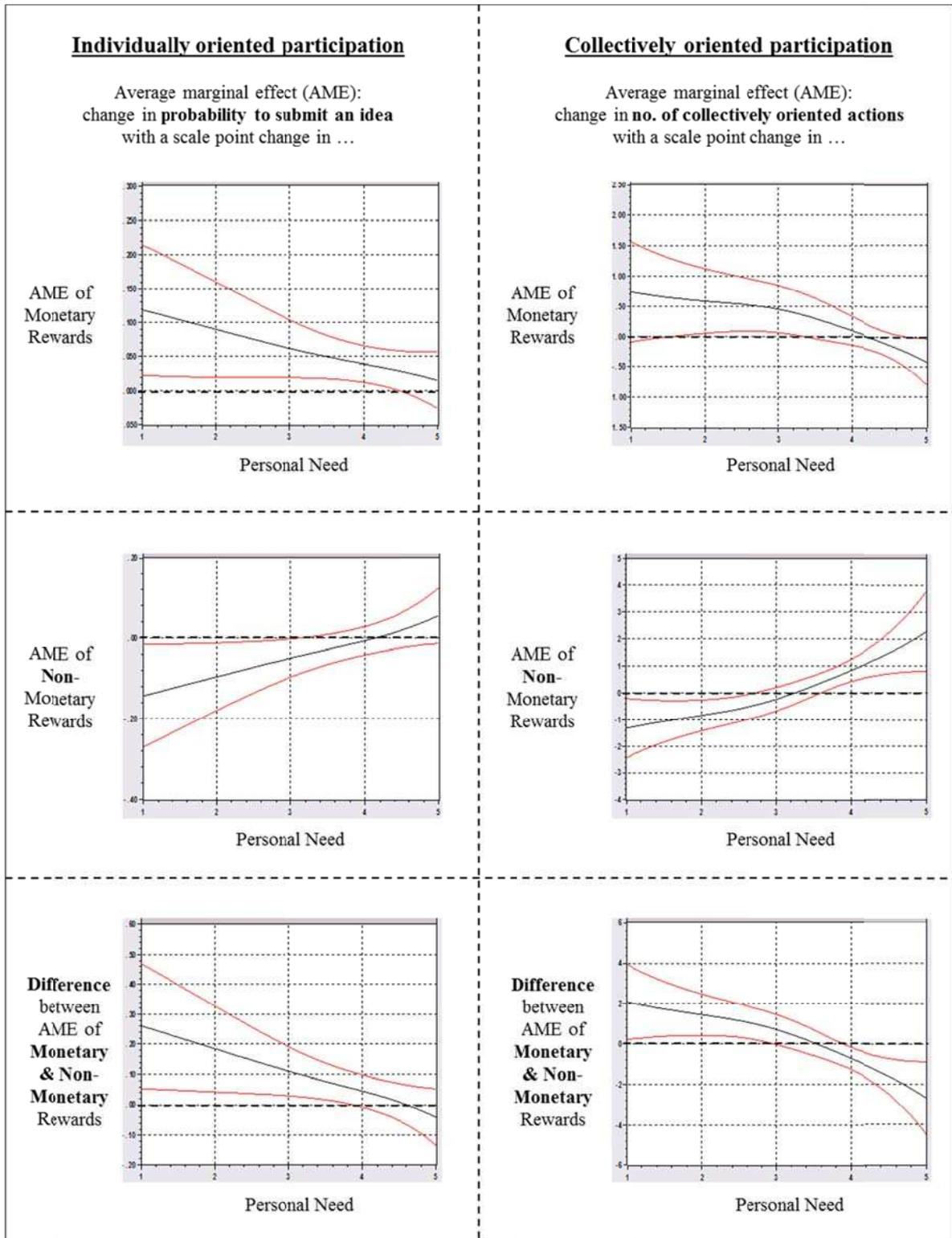
**Figure 1: Research Framework**



**Figure 2: Screenshot of ideation platform**

**-contains identification information and is therefore not included in review version-**

**Figure 3: Average marginal effects of expected monetary and non-monetary benefits as a function of personal need**



Legend: — Average marginal effect      — Upper & lower confidence interval

## TABLES

**Table 1: Regression Results**

Model	I		II		III		IV	
Dependent Variable (Regression)	Individually oriented participation (Probit)				Collectively oriented participation (Zero-inflated negative binomial)			
Independent variables	Parameter	(S.E.)	Parameter	(S.E.)	Parameter	(S.E.)	Parameter	(S.E.)
<i>Motivating Conditions</i>								
Monetary Reward	0.341 ***	(0.131)	1.671 ***	(0.645)	0.057	(0.068)	0.984 **	(0.428)
Innovation Outcome	0.111	(0.146)	-1.387 *	(0.779)	0.332 ***	(0.091)	-0.950 ***	(0.320)
Reputational Gain	-0.199	(0.166)	0.775	(0.867)	0.072	(0.074)	-0.889 ***	(0.345)
Intrinsic Enjoyment	0.053	(0.151)	-1.545 *	(0.792)	0.048	(0.087)	-0.099	(0.336)
Personal Need (PN)	0.036	(0.100)	-0.664	(0.547)	0.123 **	(0.061)	-1.043 ***	(0.331)
<i>Moderating Effects</i>								
PN * Monetary Reward			-0.309 **	(0.148)			-0.234 **	(0.096)
PN * Innovation Outcome			0.356 **	(0.179)			0.307 ***	(0.088)
PN * Reputational Gain			-0.208	(0.197)			0.243 ***	(0.084)
PN * Intrinsic Enjoyment			0.375 **	(0.182)			0.044	(0.076)
<i>Controls</i>								
Gender [Female=1]	0.040	(0.106)	-0.003	(0.111)	0.181 ***	(0.060)	0.059 *	(0.032)
Age [Years]	0.003	(0.031)	0.000	(0.031)	-0.024 *	(0.012)	-0.031 ***	(0.010)
Semester [Count]	-0.048	(0.049)	-0.051	(0.052)	-0.070 ***	(0.023)	-0.027 *	(0.016)
Constant	-2.770 ***	(0.873)	-0.199	(2.254)	-1.261 ***	(0.378)	3.483 ***	(1.321)
Overdispersion ( $\alpha$ )					9.679 ***	(0.765)	9.640 ***	(0.420)
Zero inflation ( $\tau$ )					-2.239 ***	(0.646)	-5.201 ***	(1.655)
No of obs.	470		470		470		470	
Parameters (k)	9		13		11		15	
Log likelihood (l)	-103.345		-103.345		-1,687.181		-1,687	
Log likelihood (k)	-96.941		-90.812		-404.744		-396.915	
Chi-square	12.808 *		25.066 ***		2,564.873 ***		2,580.532 ***	
McFadden R <sup>2</sup>	0.062		0.121		0.760		0.765	

Two-tailed t -tests; \* < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

**Table 2: Average Marginal Effects**

<b>Dependent Variable</b> <i>(Regression)</i>	<b>Individually oriented participation</b> <i>(Probit)</i>		<b>Collectively oriented participation</b> <i>(Zero-Inflated Neg.Bin.)</i>	
	<b>Parameter</b>	<b>(S.E.)</b>	<b>Parameter</b>	<b>(S.E.)</b>
<b>Average Marginal Effects</b>				
<i>Main Effects</i>				
Monetary Reward	0.045 ***	(0.015)	0.079	(0.121)
Innovation Outcome	0.004	(0.017)	0.539 ***	(0.191)
Reputational Gain	-0.005	(0.018)	0.168	(0.120)
Intrinsic Enjoyment	-0.006	(0.019)	0.148	(0.115)
Non-monetary Reward	-0.007	(0.021)	0.856 ***	(0.315)
<i>Interaction Effects</i>				
Personal Need * Monetary Reward	-0.028	(0.018)	-0.443 **	(0.196)
Personal Need * Innovation Outcome	0.043 *	(0.023)	0.720 **	(0.303)
Personal Need * Reputational Gain	0.045 *	(0.024)	0.514 **	(0.211)
Personal Need * Intrinsic Enjoyment	-0.027	(0.024)	0.119	(0.151)
Personal Need * Non-monetary Reward	0.063 **	(0.027)	1,353 **	(0.534)
<i>Differences between Effects</i>				
Monetary Reward - Innovation Outcome	0.041 *	(0.025)	-0.460 *	(0.244)
Monetary Reward - Reputational Gain	0.050 *	(0.026)	-0.089	(0.213)
Monetary Reward - Intrinsic Enjoyment	0.049 *	(0.026)	-0.069	(0.195)
Monetary Reward - Non-Monetary Reward	0.051 *	(0.030)	-0.777 **	(0.385)

Two-tailed t -tests; \* < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

## APPENDIX A: MEASURES

### A.1 Exploratory factor analysis

<b>Construct:</b> Personal Need ; Cronbach $\alpha = .79$ ; explained variance = 70.2%	
<b>Item: statement*</b>	<b>Item-to-total</b>
Need1: I am dissatisfied with some aspects of my studies.	.548
Need2: There is still substantial room for improvement in XXX's study conditions.	.633
Need3: Something has to change to make me completely satisfied with my studies.	.708
<b>Construct:</b> Monetary Reward ; Cronbach $\alpha = .72$ ; explained variance = 78.3%	
Mon1: I have the chance to win attractive awards.	.566
Mon2: To win the award for the best idea is a great incentive.	.566
<b>Construct:</b> Innovative Outcome ; Cronbach $\alpha = .82$ ; explained variance = 73.1%	
Outc1: This idea contest will bring about necessary changes for XXX.	.612
Outc2: This idea contest will make a contribution to XXX's development.	.712
Outc3: This idea contest will influence XXX's development.	.732
<b>Construct:</b> Reputational Gain ; Cronbach $\alpha = .80$ ; explained variance = 62.9%	
Rep1: I can make a good impression with my participation.	.615
Rep2: Others become aware of me.	.619
Rep3: I am able to impress others with my ideas.	.604
Rep4: I can present myself as a key member of XXX.	.747
<b>Construct:</b> Intrinsic Enjoyment ; Cronbach $\alpha = .83$ ; explained variance = 75.2%	
Enj1: Participation is very exciting.	.674
Enj2: Participation is great fun.	.734
Enj3: Participation is very entertaining.	.677
Enj4: Participation is a good pastime. <sup>a</sup>	.488

\* All items were rated on 5 point Likert scales and anchored "strongly disagree - strongly agree".

<sup>a</sup> Item was deleted in further analysis.

## A.2 Confirmatory factor analysis

<b>Construct: Personal need</b>						
<i>Item</i>	<i>Item reliability</i>	<i>Item loading (stand.)</i>	<i>t-value</i>	<i>Construct reliability</i>	<i>Explained variance</i>	<i>Fornell-Larcker ratio</i>
Need1	.379	.615	--			
Need2	.545	.738	12.226***	.800	.579	.017
Need3	.788	.887	11.651***			
<b>Construct: Monetary reward</b>						
<i>Item</i>	<i>Item reliability</i>	<i>Item loading (stand.)</i>	<i>t-value</i>	<i>Construct reliability</i>	<i>Explained variance</i>	<i>Fornell-Larcker ratio</i>
Mat1	.529	.727	--			
Mat2	.605	.778	11.169***	.726	.574	.803
<b>Construct: Innovative Outcome</b>						
<i>Item</i>	<i>Item reliability</i>	<i>Item loading (stand.)</i>	<i>t-value</i>	<i>Construct reliability</i>	<i>Explained variance</i>	<i>Fornell-Larcker ratio</i>
Outc1	.482	.694	--			
Outc2	.708	.841	14.817***	.821	.607	.566
Outc3	.618	.786	14.433***			
<b>Construct: Reputational Gain</b>						
<i>Item</i>	<i>Item reliability</i>	<i>Item loading (stand.)</i>	<i>t-value</i>	<i>Construct reliability</i>	<i>Explained variance</i>	<i>Fornell-Larcker ratio</i>
Rep1	.492	.701	--			
Rep2	.506	.711	13.364***			
Rep3	.477	.690	13.029***	.804	.507	.909
Rep4	.549	.741	13.823***			
<b>Construct: Intrinsic Enjoyment</b>						
<i>Item</i>	<i>Item reliability</i>	<i>Item loading (stand.)</i>	<i>t-value</i>	<i>Construct reliability</i>	<i>Explained variance</i>	<i>Fornell-Larcker ratio</i>
Enj1	.605	.778	--			
Enj2	.707	.841	17.151***			
Enj3	.580	.762	16.002***	.836	.629	.595
Enj4	--	--	--			

\*\*\*:  $p < .001$

## **APPENDIX B: FORMULAS TO CALCULATE AVERAGE MARGINAL EFFECTS**

### **B.1 Derivatives of the predicted probabilities function for probit model**

First derivative with respect to monetary or non-monetary benefit:

Second derivative with respect to personal need:

### **B.2 Derivatives of the expected mean function for zero-inflated negative binomial model**

First derivative with respect to monetary or non-monetary benefit:

Second derivative with respect to personal need: