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TOWARDS MEASURING CROWDSOURCING SUCCESS: AN EMPIRICAL STUDY ON EFFECTS OF EXTERNAL FACTORS IN ONLINE IDEA CONTEST

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Abstract

Crowdsourcing campaigns in general and online idea contests in particular have reached popularity in practice and research. Based on the open innovation paradigm, idea marketplace providers like InnoCentive broker ideas between a potentially large-scaled crowd of solvers and seeking firms by hosting idea contests in the web. So far, research has mainly focused on the setup of idea marketplaces, design patterns to define idea contests or motivation factors to spur solvers. Mostly, extrinsic incentives, especially rewards for best ideas, are used to guarantee high amounts and good quality of ideas. In contrast to the predominant qualitative and conceptional research on online idea contests, we attempt an empirical study. We derive external factors, like rewards, contest-duration or market-maturity, to construct a model depicting effects of these factors on the outcome of online idea contests. We use a dataset from Atizo, containing over 25'000 submitted ideas and over 83'000 ratings to evaluate validity of our model. Our findings show that current design elements of online contest may not contribute to the commonly expected effects. One interesting aspect is that using rewards to maximize quality and quantity of ideas creates a conflict of goals as rewards can have perverse effects on the outcome.

Keywords: idea contests, crowdsourcing, open innovation, empirical study

1 INTRODUCTION

Online idea contest, also called innovation tournaments (Terwiesch and Ulrich, 2009) represent a relatively new form of electronic marketplace. Also often referred as crowdsourcing (Howe, 2006, Howe, 2008) approach, companies or institutions take an idea- or concept-seeking process, once performed by employees, and outsource it to an undefined (and generally large) group of people in the internet. In this occurrence of an electronic marketplace, ideas (potential innovations) are traded like information goods (Shapiro and Varian, 1998), which are produced by working consumers and demanded by solution-seeking companies or institutions (Singh and Wittman, 1988, Archak and Sundararajan, 2009). Like in other electronic marketplaces, operating the marketplace itself has become a promising business model. Companies such as InnoCentive, Presans or IdeaConnection run such idea marketplaces and offer crowdsourcing as value proposition. Through hosting idea contests online they act as intermediaries between idea- or innovation-demanding companies (called seekers) and a large-scaled crowd of potential working consumers (called solvers) in the internet. Idea marketplace providers gain revenues as seekers pay for the opportunity of tapping the wisdom of crowds (Surowiecki, 2004), particularly expressed through a large amount and high quality of submitted ideas. Thus, (Spradlin, 2010), CEO of InnoCentive, suggests thinking about their business model as "the ebay of innovation". Following this description, idea marketplaces are causing changes to the supply side of innovation (Archak and Sundararajan, 2009). Through offering a large scaled base of potential solvers, including various customer experiences, skills, backgrounds and tastes, seeker's potential benefits are based on reduced matching costs and increased diversity. In other words, seekers don't have to search for suitable solvers, but pluralities of solvers can select tasks they feel attracted to and submit suggestions unconstrained.

Various success stories of idea contests (e.g. InnoCentive, Dell IdeaStorm, myStarbucksidea, Cisco iPrize, etc.) also accelerated research. Mainly from a conceptual point of view, information systems (IS) research deals with design patterns of innovation platforms, economics develop models of prize structures or incentive schemes for such contests, whereas sociologists mostly search for intrinsic motivation factors among the solver crowd. Furthermore, the concept of idea contests is not an invention of the short termed past. E.g. research on free and open source software (FOSS) communities or electronic brainstorming tools deals with the parts of the concept for years. Despite this growing amount of research papers, basic rules and tenets of online idea contests have not yet been carved into stone. One major reason for this is, that less empirical studies have been undertaken, dealing with data from real online idea contest. Hence, even though there are various assumptions on influential factors, there is less clarification which factors can be applied to support high and valuable outcomes, i.e. a plurality of precious ideas. At a basic level, it becomes a crucial issue of idea marketplace providers (like InnoCentive) as well as innovation seeking companies to understand, which external factors cause effects on the outcome. Once

understood, in return marketplace operators may use these factors as a driving belt to increase the outcome and finally offer a stronger value proposition. This gave rise to our constitutional research focus:

Which (measurable) external factors take effects on the outcome of online idea contests?

To answer this question we start with a literature review, focusing on IS research as well as, economic or sociologic work to provide a basis for hypothesis how idea contests should work from a theoretical point of view (Chapter 2). We restrict the analysis on extrinsic factors, which are either given externally by the nature of an online idea platform or regard definable structural and design elements of online idea contests. Thus, we exclude internal and behavioral factors which are directly dependent and only measurable by interacting with the solvers, e.g. measuring their individual efforts (Lakhani et al., 2006), their networks (Ye and Kishida, 2003, Huberman et al., 2009, Franke and Shah, 2003), their skills, backgrounds and intrinsic motivation level (Lakhani et al. 2005, Shah, 2006) or feedback processes during running idea contests (Nov et al., 2009, Yang et al. 2009). Based on the literature review we develop 4 models, predicting the effects of external factors on the outcome of online idea contests (Chapter 3). We evaluate these models by applying a dataset from practice, derived from Atizo (an idea marketplace provider like InnoCentive). We describe data collection and run descriptive analysis (Chapter 4) as well as OLS regression, using the sample of all closed contests since the first contest in 2008, containing over 25.000 submitted ideas (Chapter 5). Concluding we discuss the validity of our results and provide a glance of implications on idea contest design on idea marketplaces as questions of future research (Chapter 6).

2 THEORETICAL BACKGROUND

A plurality of partly overlapping or constitutive theories can be identified dealing with aspects of idea generation processes. Hence, our initial task is to define how crowdsourcing and idea contests relate to other existent theories (2.1) and subsequently to define tenets within these theories, which describe which external factors contribute towards the outcome of online idea contests (2.2).

2.1 Classification of relevant terms

Within the last decades a plurality of partly overlapping terms has been defined within the field of *open innovation*. *Open innovation* can be traced back to the definition of (Chesbrough, 2003) as the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets or external use of innovation, respectively. Hence, the *open innovation* paradigm can be understood as the antithesis of the traditional vertical integration model where internal R&D-activities lead to internally developed products that are then distributed by the firm (Chesbrough et al., 2006, Laursen and Salter, 2006). *Open innovation* is set in the field of R&D and thus a part of *new product development*, which is defined the complete process of bringing a new product or service to market (Lilien et al. 2002, Ulrich and Eppinger, 2004). Furthermore, *open innovation* can include *user innovation* (von Hippel, 2005) or *customer co-creation* (Prahalad and Venkatram, 2000), which both refer to an innovation where users have performed a substantial part of the problem-solving process leading to a solution. A group of customers, which solve a company's R&D problem, creates a *user innovation community*, which is defined as a distributed group of individuals focused on solving a general problem and/or developing a new solution, applying computer mediated communication (di Gango and Wasko, 2009). As the importance of customer inputs further increase with the market newness of a product, it becomes more critical to enlarge *user innovation communities* (Callahan and Lasry, 2004). *FOSS Communities* are yet another example of a *user innovation community* in which information, assistance, and innovations is freely shared (Franke and Shah, 2003).

Research from the area of *open innovation* often references the existence of a *swarm-* or *collective-intelligence* as defined by (Lèvy, 1997, Bonabeau, 2001, Bonabeau, 2009), and depicted as the *wisdom of crowds* by (Surowiecki, 2004). The *wisdom of crowds* states that the aggregation of information in groups results in decisions which are often better, than made by any single member of the group (Surowiecki, 2004). Various systems or tools which are used to tap the *wisdom of crowds* and support collaboration- or idea production-processes have been mentioned: (de Sanctis and Gallupe, 1987) defined the term *group decision support systems*, (Numaker et al., 1991) defined *electronic brainstorming* tools, (Berg et al., 1996) defined *prediction markets*, years later (Piller and Walcher, 2006) defined *toolkits for idea competitions*, and (Back and Wagner, 2008) defined *group wisdom support systems*. The commonness of such tools is, that they try to transform the phenomena of the *wisdom of crowds* (or *collective intelligence* respectively) into a structured process of value creation (Jones et al., 2009). This leads towards the definition of *crowdsourcing*. The basic concept behind *crowdsourcing* is that crowds of amateurs can fulfill tasks and gather contributions at least as valuable but less

cost-intensive than internal R&D departments (Howe, 2006, Howe, 2008). Similar to open innovation, *crowdsourcing* has a strong focus on R&D processes, especially on lowering R&D costs or enhancing R&D quality (Howe, 2008, Leimeister et al. 2009). *Crowdsourcing* is increasingly seen as a strategic model to attract an interested, motivated crowd of individuals capable of providing solutions superior in quality and quantity to those experts can (Girotra et al., 2010, Brabham, 2008). Consequently, *crowdsourcing* can be described as an process of *open innovation* harnessing or leveraging the *wisdom of crowds*. During implementations of a *crowdsourcing* strategy, often *idea contest* (or *innovation tournaments*) are set up on company websites (e.g. Dell Idea Storm, Cisco iPrize, IBM Innovation Jam, MyStarbucksIdea, Threadless) or on mentioned idea marketplaces (e.g. InnoCentive, PRESANS, TekScout, IdeaConnection, NineSigma, Innovation Exchange, 99 designs, Atizo, etc.). Using *idea contests* to leverage innovation processes is also not an invention of the short-term past, e.g. (Amabile, 1988) suggested *idea contests* to manage ideas within organizational structures. Generally, an *idea contest* is a game in which several agents spend resources in order to win one or more prizes (Moldovanu and Sela, 2001). (Ebner et al., 2008) define *online idea contests* as "the invitation of a private or public organizer to a general public group to submit contributions to a certain topic within a timeline. An idea-reviewers committee evaluates these contributions and selects the rewarded winner."

2.2 Effects of External Factors on the Outcome of Idea Contests

As the previous chapter shows, idea contests do neither establish an entirely new, nor independent area of research. In fact, previous research on open innovation, electronic brainstorming, FOSS communities, but also research in the fields of economic contest design, behavioral economics or sociology also contribute predictions on the potential effects of external factors within idea contests. A basic tenet of all these research areas is that certain factors operate as incentives which potential solvers perceive and then activate. Hence, the right mixes of incentives are those that appeal to or match the solver's motivation for participating (Leimeister et al., 2009, Riggs and von Hippel, 1994). Basically extrinsic and intrinsic incentives are distinguished. Accordingly, we say that a solver is intrinsically motivated if he engages in an activity to feel competent and self-determining in relation to the activity. There is no external reward, rewards are internal to the solver and take the form of feelings he has on himself (Deci, 1978, Amabile, 1997). Within our research we do not focus on intrinsic motivation factors. However, we will acknowledge the following:

Research showed, that attempts to measure intrinsic effects within online idea contests has to be based on qualitative research methodology, i.e. mostly interviews or surveys among a crowd of solvers. Significant intrinsic factors include the desire to acquire new skills, the desire to learn, the passion for problem solving and exploration (often at the boundary or outside fields of expertise), enjoyment or the interest in free-sharing of ideas (Lakhani et al. 2006, Lakhani and Wolf, 2005, Franke and Shah, 2003, Shah, 2006). For further qualitative attempts to measure intrinsic factors see (Antikainen and Väätäjä, 2010, Lakhani et al. 2006, Stenmark, 2002). In the following we focus on our primary interest, the idea marketplace perspective. We will depict several extrinsic factors which may appear on marketplaces of idea contest. We structure the literature search for tenets on external factors by separating the research areas open innovation/ crowdsourcing from FOSS communities/ electronic brainstorming and economics/ sociology.

2.2.1 Open Innovation and Crowdsourcing Research

From an IS perspective external factors often are associated or identified as so called "design elements" (Nov et al., 2009). Similar to external factors, design elements are partly given by the circumstances of an online marketplace and can be set or adjusted by the marketplace operator. (Haller et al., 2009) deduce 24 design elements from analyzing 27 online idea contests. Among these design elements they find *specificity of tasks*, *contest period* and *reward* as relevant external and adjustable factors. 9 design elements focus on the idea evaluation process, which is not our focus and others are not adjustable, like the *type of contest organizer*. (Piller and Walcher, 2006) develop a matrix, by which toolkits for idea competitions can be defined through the *task specificity* and the *required degree of elaboration*. (Ebner et al., 2008) build up an online idea contests and define 12 characteristics. (Leimeister et al., 2009) further develop this project and narrow down the list to 6 essential characteristics, including the *contest timeline*, *incentives*, *problem specification* and *elaboration*. Additionally they define 8 types of incentives, including *prizes*, *profit options* and *career options*. They find that getting aligned with a seeking company (i.e. the *seekers brand strength*) has a stronger influence than *monetary prizes*. (Walter and Back, 2010) find similar results in a qualitative study of four crowdsourcing case studies. These findings go along with a plurality of case studies in on open innovation, which all find that without direct *monetary compensation*, a vast number of resources are committed to open innovation (Chesbrough, 2006, Chesbrough and Appleyard, 2007, Nickerson et al. 2009, Brabham, 2008). (von Hippel and von Krogh, 2003)

find reasons of this in relative low *costs of submitting to online contests*. Hence, even low amounts of *monetary rewards* can have sufficient effects on contributions. In their recent empirical study, (Yang et al., 2009) try to prove this and conduct research on factors which affect the outcome of online idea contests. They define the amount of attracted solvers as dependent variable and find that *rewards* attract more people as well as longer *contest duration* or fewer words *used to define the contest question*. (Huberman and Romero, 2009) define the *possibility of free-riding* as rationale of participating in crowdsourcing. They find that freely consuming the ideas of others satisfies most solvers. Additionally they find that paid attention by other solvers, e.g. via the existence of an *idea rating system* can additionally enhance participation. Research of (Antikainen and Väätäjä, 2010) supports this finding. According to their study 2/3 of all solvers contribute due to the pure *existence of a reward system*, which can contain a *solver ranking*, e.g. a top ten list, next to basic *monetary rewards*. (Morgan and Wang, 2010) develop a two step decision tree to design idea contests which is based on the demanded *degree of disruptiveness of ideas* and the *solvers skill profile*. Based on these factors they suggest different distribution styles and absolute values of *monetary rewards*. Their basic suggestion is to use higher and more divergent rewards, the more the skills vary among solvers.

2.2.2 Research on FOSS Communities and Electronic Brainstorming

Similar to idea contests, FOSS projects and electronic brainstorming groups are unlikely to be successful unless there is an accompanied community that provides the platform for developers and participants to collaborate (Ye and Kishida, 2003). FOSS Projects include external factors, as programmers *often get paid* by their employer to participate in order to improve their skills, which is also seen as investment in human capital (Lakhani and Wolf, 2005). (Lerner and Tirole, 2002) find the biggest external motivation factor of FOSS projects in a *delayed reward*, expressed by enhanced *career opportunities* of participants. (Nov et al., 2009) separate motivational, structural and tenure factors as causes of user contributions in online communities. Tenure factors especially focus on *maturity of the group*, measured by *years of existence or experience*. Within the research area of electronic brainstorming (Michimov and Primois, 2005) find that group productivity and creativity is most dependent on the factor of *provided feedback*. Additionally they find that *social comparison*, such as a *ranking of suggestions* also enhances productivity. In contrast, (Stenmark, 2002) finds that the introduction of *rewards* lead to poorer, i.e. uncreative, results in electronic brainstorming as a level of competition lowered the users' ability to be creative. Additionally the limited *amounts of time as well as the detailedness of task description are* seen as positive external factors.

2.2.3 Economic and Sociologic Research

Economists are also interested in *rewards* as an external factor of idea generation. Absolute values as well as *reward structure* are central research issues in tournament- and contest-design. In contrast, *contest duration* and *contest declaration aspects* are subordinate as tournament models commonly use two participants and one or two rounds of action (Archak and Sundararajan, 2009, Singh and Wittman, 1988, Yang et al., 2009). Even though economists do no longer base their entire argumentation on the assumption of rational behavior, *rewards* are still used as main external factor and thus, mostly used to model human behavior on marketplaces. But the effects of monetary compensation on performance are no longer seen as monotonic, which means that offering money does not always produce an improvement (Gneezy and Rusticini, 2000). Economic research recently states some law of diminishing utility of rewards on participation in innovation tournaments. The main statement is that relatively high *monetary incentives* can have perverse effects on performance, which means adding additional incentives will decrease performance from some point (Ariely et al. 2009a). (Ariely et al. 2009b) further show that tasks, which involve quantitative effort only, e.g. pressing a button as often as possible within a definite time, are more likely to benefit from increased *rewards*, whereas tasks, which require a cognitive component, include a level beyond which further increases of incentives induce negative effects on performance. Sociologist and behavioral economics call this overjustification-effect, depicting *paying too much* can induce a crowding-out of so called prosocial behavior and finally lead to poorer *quality of results* (Frey and Oberholzer-Gee, 1997, Bènabou and Tirole, 2006). This is based on tenets like intrinsic *rewards* as superior to extrinsic in causing action of individuals (Amabile, 1997), *rewards* significantly undermining the free-choice of intrinsic motivation (Deci et al., 1999), extrinsic and intrinsic *rewards* not being compatible in incentive design (Deci, 1978) and finally *rewards* undermining real interests, ignoring reasons and discouraging risk-taking (Kohn, 1993). Economic research also states that investments of solvers tend to be sunk (Singh and Wittman, 1988), Hence, with a large-scaled group of solvers, each will have relatively small chance of winning, so the winner's investment and hence, the *quality of the winning suggestion* will tend to be low (Che and gale, 2003). Furthermore huge *amounts of ideas* cause higher costs as the real value proposition offered by marketplace

operators comes in locating, filtering and communicating what is useful to the seeker (Varian et al., 2004). In other words, large *amount of ideas* also causes higher costs of extracting valuable from useless ideas. Based on this (Terwiesch and Xi, 2008) state that inefficiency of idea contests is resulting from the solvers' underinvestment and this can be reduced by changing the *rewards structure* from a fixed-price to a performance-contingent type.

3 HYPOTHESIS AND PREDICTION MODEL

During chapter 2 diverse *external factors* (signaled by italic presentation) have been deduced from various areas of research. Chapter 3.1. states hypothesis, derived from this literature review, 3.2 explains how variables will be measured and 3.3. finalizes the prediction models.

3.1 Hypothesis

- Hypothesis 1: Higher *rewards* will lead to a higher outcome of online idea contests.
- Hypothesis 2: Longer *contest duration* will lead to a higher outcome in online idea contests.
- Hypothesis 3: A shorter *description of tasks* will lead to a higher outcome of online idea contests.
- Hypothesis 4: Highly *specific tasks* will have a lower outcome of idea contests.
- Hypothesis 5: The suggested *type of answering* will lead towards different outcome levels of idea contests.
- Hypothesis 6: The *maturity of the marketplace* will have positive influence on the outcome of online idea contests.
- Hypothesis 7: The *brand-strength of seekers* will have positive influence on the outcome of online idea contests.
- Hypothesis 8: Idea contest where *brand strength of a seeker and rewards* are relatively high will generate a high outcome.
- Hypothesis 9: The *specificity of tasks* will response to the set *reward*.
- Hypothesis 10: The requested *type of answers* wills response to the *duration* of online idea contests.

All derived hypothesis are collected and shown in Figure 1, an illustration of the potential external factors on the outcome of online idea contest.

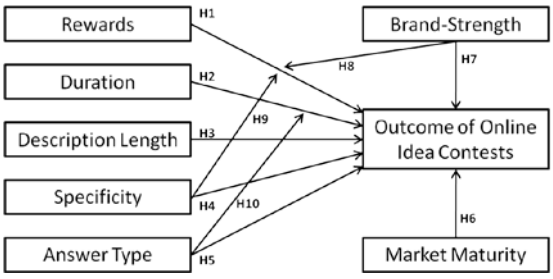

Figure 1: Hypothesis of potential external factors on the outcome of online idea contests

3.2 Variables Measurement

We are restricted to measurable outcomes of idea contests. Literature suggests measuring effectiveness of idea contests in 1) *number of submitted ideas*, 2) *the quality of ideas* and 3) *the rarity of ideas* (Conolly et al., 1990). Other suggestions are to measure the *amount of attracted solvers* (Yang et al., 2009) or solely the *quality of the best (winning) idea* (Girotra et al., 2010). We decided to exclude *rarity of ideas* as well as the *quality of the best idea* as these are mainly subjective factors. *Attracted amounts of solvers* are also blurry as the stages of participation vary from submitting ideas, towards commenting the ideas of others until only following contests and reading ideas. An additional bias would be that users are allowed to submit various ideas to one contest. Hence, we set *submitted ideas* as first dependent variable, meaning we count the *total amount of submissions to an idea contest*. Solvers are allowed to submit several ideas to one idea contest and seekers can already mark *submitted ideas* as "interesting" while a contest is still running and therewith maybe influence the solvers behavior. Seekers intervened idea contests by marking ideas as interesting 170 times (which states 0.6% of all ideas within our dataset). In a second regression we define the *average quality of submitted ideas* to an idea contest as dependent variable. Therefore we use the given rating system within the Atizo community, where each

idea can be rated on a 5-point scale from 1, “almost useless idea”, to 5 “idea with options to win the contest”. The rating of ideas is also done by the solver community. Table 1 provides an overview of the dependent variables (*amount* and *quality*), the seven independent variables, derived during hypothesis building in chapter 3 and all corresponding methods of measurement. All variables refer to the entity of an online idea contest. The *task type* is defined by the seekers description of task, especially by mostly given rating criteria, in which certain submission styles are suggested or announced. *Brand-strength* and s*pecificity* of tasks are purely subjective factors. In order to measure the effects of these we defined values of seekers *brand-strength* and task *specificity* on the scale of 1 (lowest, worse) to 5 (highest, best). We tried to eliminate potential biases due to subjective determinations of values by applying inter-rater reliability technique, i.e. multiple classifications by 3 research assistants. Additional determination of values was undertaken by Atizo in order to affirm no local specifics have been ignored. Fleiss’ Kappas of 0.94 (*brand-strength*) and 0.81 (*specificity*) shows high concordance among all raters’ valuations (Fleiss, 1971).

Variable	**Method of Measurement**	**Variable**	**Method of Measurement**
Amount (dependent)	Total submitted ideas of an idea contest.	*Specificity*	Subjective measure of required skill level, necessary to submit an idea to an idea contest (scale of 1-5).
Quality (dependent)	Average quality of all ranked ideas of an idea contest.	*Task Type*	Suggested answer types categories: Naming, Designing, Engineering or Business Solution
Reward	The amount of money in Swiss Chf, accounted for one or many winning ideas of an idea contest.	*Market Maturity*	Month counted from September 2008 till launch of an idea contest.
Duration	Days from contest start till contest end of an idea contest.	*Brand Strength*	Subjective measure of seekers brand-strength (scale 1-5).
Descripti-on length	Amount of words used to describe the task of an idea contest.		

Table 1 Dependent and independent variables and methods of measurement

3.3 The Model

We use ordinary least squares (OLS) for multiple regression analysis to determine size and strength of relationships between dependent and independent variables. OLS is commonly used during structural equation models like this. It is also commonly used in cited studies on online idea contests (e.g. see Ariely et al., 2009b, Giora et al. 2010, Lakhani and Wolf, 2005, Yang et al. 2009) what makes results partly comparable. The dataset shows no runaway values, so we do not see the requirement of a logarithmic description (e.g. as in (Yang et al., 2009)) and we found no bias through multicollinearity underneath independent variables. A test of inter-item reliability for independent variables revealed acceptable Cronbach alpha of 0.72 (Aiken and West, 1991). Finally this leads us towards four prediction models. The first two predict effects of basic external factors on quantity and quality of idea contests as the following:

$$\text{Outcome (Amount, Quality)} = \beta_0 + \beta_1(\text{Reward}) + \beta_2(\text{Duration}) + \beta_3(\text{Description Length}) + \beta_4(\text{Specificity}) + \beta_5(\text{Task Type}) + \beta_6(\text{Market Maturity}) + \beta_7(\text{Brand Strength}) + \xi$$

The second two models enhance the predictions of the basic model by including interaction terms between variables:

$$\text{Outcome (Amount, Quality)} = \beta_0 + \beta_3(\text{Description Length}) + \beta_6(\text{Market Maturity}) + \beta_8(\text{Reward*Specificity}) + \beta_9(\text{Reward*Brand-Strength}) + \beta_{10}(\text{Task- Type*Duration}) + \xi$$

In both cases the outcome is separated into amount and average quality of ideas. The term ξ covers a random error. Only the extended models include hypothesis 8, 9 and 10, which all state that variables intercommunicate. Hence, we cut out variables in their detached form (as in the basic model) and only use the combinations. The data for the regression was obtained via access to the Atizo database, which included all closed idea contests, including the corresponding *rewards, amounts* of submissions, average *quality* of submissions towards an idea contest, start- and ending dates of contests and name of seeking organization. R (Version 2.11.0) was used to calculate the regression models.

4 DATA COLLECTION AND DESCRIPTIVE STATISTICS

4.1 The Atizo Platform

Atizo was founded June 2008 in Bern, Switzerland. The company defines its business model as the following:

Atizo administers a growing web-community of creative thinkers, who are characterized by their user, consumer and special knowledge. For the mobilization of this community and yet other innovator teams, Atizo continually develops innovation management tools, which are applied in innovation projects of companies and organizations of all sizes and sectors (Atizo, 2010).

Atizos' standard idea generation process is the following. Seekers formulate a task description including suggested or required formats of submissions. Additionally seekers decide on rewards, whereas Atizo consults, which reward seems adequate to the specified problem. In the following, the task is posted on the platform, free for all signed-in solvers to submit ideas, comment on other ideas and rates other ideas within a public online brainstorming phase. In a next step seekers select one or more best ideas (which does not have to be in accordance with the average rating from the crowd of solvers) and divide the rewards. Hence, before or during a running contest solvers are not aware, whether there will be one fix price winner or a reward split into the best five ideas, but only the total size of distributed rewards.

4.2 Descriptive Statistics of Online Idea Contests on the Atizo Platform

The first idea contest was opened and hosted by Atizo in September of 2008. Since then 74 idea contests have been closed. Contests lasted between 4 and 135 days, but 57.3 days at the average (Std Dev 20.7). 7013 solver accounts have been opened yet, from which 1545 should be counted as active, requiring having posted an idea at least one time every six month. 156.500 Chf of rewards have been distributed yet. This states an average reward of 2200 Chf (Std Dev 1175.7) per idea contest (which is way below the prizes, InnoCentive offers to their solvers). Atizo suggests seekers to use rewards between 500 and 10'000 Chf. Six contests were set up by non-profit-organizations or seekers which requested to "donate an idea", stating no rewards (0,- Chf). In general, idea contests at Atizo are mainly of a general type. (Hallerstede et al., 2010) analyzed ten idea marketplaces and found that contest on Atizo are rather focused on brainstorming and hence, less expert knowledge and detail is required. However, specificity of tasks also varies among the Atizo platform and of course it is not forbidden for solvers to submit highly sophisticated ideas. Seekers announced their idea contest tasks using 140 words in average (Std Dev 24.8). Thereby the most frequent suggested answer type (and hence, the biggest answer category) was the form of describing a product or strategy with text (35%). 21 Contests (28%) demanded engineering solutions (e.g. a technical proof), 17 (23%) only searched for product or service names and therewith could be answered by one line and 10 Contests (13%) requested ideas on design which includes to submit a drawing in the appendix.

Within all contests 25'730 ideas have been posted, which turns to an average of 347 ideas per contest (Std Dev 164.8). 925, and therewith most ideas underneath all contests, were submitted to a question of suggesting a new name of a student platform, offering 1000 Chf only. Only one contest includes less than 100 submissions, stating 94 ideas as a minimum. Considering different durations of idea contest, between 1.4 and 46.8 ideas were submitted per day and contest, concluding an average of 7.5 (Std Dev 12.1) submitted ideas every day regarding all contests.

In total 83.245 ratings of ideas have been submitted. Not each submitted idea was rated, but only 10'856 (42% of 25'730 totally submitted). The average value of these rated ideas is 1.68 on a scale of 1-5 (Std Dev 0.49). Hence, the dataset for modeling the quality was narrowed down to these 10'856 ideas (still including all 74 idea contests). This states the average value of a rated idea is based on 7.7 submitted ratings (Std Dev 5.3), and the value of average quality of ideas within an idea contest is based on 1'124.9 submitted ratings (Std Dev 432.3).

5 RESULTS AND ANALYSIS

Using the dataset, described in chapter 4.2, we test 4 prediction models, derived during chapters 2 and 3, Table 3 shows the results for all 4 models. In each case, the basic model applies the basic variables whereas the extended model also includes interactions between variables, which are requested by hypothesis 8, 9 and 10.

Measuring effects on the first dependent variable, the amount of ideas, the basic model shows a significant effect of rewards (β_1). This supports hypothesis 1. A second, strong effect is given by the market maturity (β_7), which is

significant in each of the cases, the basic and the extended model. Further significant, but less strong, factors are set by duration of contests (β_2) and the seekers brand-strength (β_6). This supports hypothesis 2 and 7, which suggest that longer contest periods and strong brands will have positive effects on the amount of ideas. (β_4), which represents the effects of task specificity, is negative in the basic model, but positive in combination with rewards within the extended model. This suggests that idea contests tend to have less submitted ideas as task complexity rises, but high rewards are able to reverse this effect. Hence we are able to support hypothesis 4 and 9. The results also show that description-length (β_3) and type of required submission (β_5) style have no significant effect on the amount of ideas. In other words, no matter how seekers describe a task or what kind of submission style they suggest, solvers will send ideas. This also counts in cases of the extended model (β_{10}), where the assumption is that answer types interact with contests duration. Hence, we reject hypothesis 3, 5 and 10. Regarding their prediction quality, the basic model is slightly stronger, explaining about 60% of variance on the amount of submitted ideas in online idea contests (compared to 37% in the extended model).

(β_i)*Variables*	Effects on the average **quality** of rated ideas per contest		Effects on the **amounts** of submitted ideas per contest	
	Basic Model	**Extended Model**	**Basic Model**	**Extended Model**
(β_0) *Intercept*	-29.31 (15.45)*	-42.6 (13.82)***	-12938 (4770)***	-11877 (4831)**
(β_1) *Reward*	0.000	-	0.052 (0.017)***	-
(β_2) *Duration*	0.004 (0.003)	-	1.712 (1.020)*	-
(β_3) *Description-Length*	-0.001 (0.002)	0.002 (0.002)	0.196 (0.758)	0.052 (0.812)
(β_4) *Specificity*	-0.0566 (0.057)	-	-29.732 (17.513)*	-
(β_5) *Answer-Type*				
(Naming)	0.045 (0.342)*	-	-30.796 (50.163)	-
(Designing)	0.348 (0.203)	-	-65.999 (62.635)	-
(Engineering)	0.357 (0.202)*	-	-36.642 (62.475)	-
(Business Sol.)	0.070(0.162)*	-	-30.796 (50.163)	-
(β_6) *Brand-Strength*	0.035 (0.038)	-	20.810 (11.991)*	-
(β_7) *Market-Maturity*	0.009 (0.005)**	0.012 (0.004)***	3.929 (1.419)***	3.679 (1.429)*
(β_8) *Reward*Brand-Strength*	-	0.000	-	0.014 (0.009)
(β_9) *Reward*Specificity*	-	0.342 (0.118)***	-	0.0273 (0.016)*
(β_{10}) *Answer-Type*Duration*	-			
(Naming)		-0.015 (0.011)**		-1.334 (2.606)
(Designing)		-0.014 (0.015)	-	-2.199 (5.373)
(Technical Sol).		-0.02 (0.008)***		0.442 (2.803)
(Business Sol.)		-0.018 (0.007)**		-1.334 (2.606)
N	74			
R^2	0.1712	0,6164	0,5972	0.3695
Level of significance	***p < 0.001; **p < 0.05; * p < 0.1			

Table 2 OLS Regression Analysis for Modelling the Amount and Quality in Online Idea Contests

Our second, dependent variable is average quality of rated ideas per contest. A central statement is that in this case different external factors have significant effects than in modeling the amount of submitted ideas. As Table 2 shows, within the basic model rewards (β_1), duration (β_2), description-length (β_3), specificity (β_4) and brand-strength (β_6) cause no significant effect on the average quality of rated ideas within a contest. This suggests rejecting hypothesis 1,2,3,4 and 6 in this case. Also the validity of predictions using the basic model is weak, as it only explains about 17% of the variance in idea quality per contest. However, the prediction quality of the extended model is unequally better ($R^2 = 0.62$). Within the extended model, especially the variables describing the interaction between external factors (β_9 and β_{10}) show significant effects. These results suggest that higher rewards only lead towards better quality of ideas, if they are offered in highly specific contests. As effects of answer-types were slightly positive in the basic model, this effect is partially turned around through the extended model. The regression suggests that in all answer-types (except designing) a longer duration leads towards a lower average quality of ideas. Therewith we see support for hypothesis 10. Finally, again the market-maturity (β_7) has a strong positive effect on the outcome.

6 CONCLUSIONS AND LIMITATIONS

Even though IS research has been concerned with open innovation (e.g. Chesbrough, 2003, Laursen and Salter, 2006, Thomke and von Hippel, 2008) or community design (e.g. di Gangi and Wasko, 2009, Ebner et al., 2008, Nov et al., 2009, Stenmark, 2002) for years, the rules for online idea marketplaces have not yet been carved into stone. Platforms (e.g. Hallerstede et al., 2010), design elements (e.g. Haller et al. 2009, Leimeister et al., 2009, Piller and Walcher, 2006) as well as seeker- (e.g. Gassmann and Enkel, 2004, Lilien et al., 2002) or solver-behavior (e.g. Franke and Shah, 2003, Lakhani et al., 2006, Lakhani and Wolf, 2005) has been studied, but yet little is known about the actual effects such factors might cause. Of cause, this is also partly due to the fact that such marketplaces are young phenomena and thus research lacks of a plurality of datasets. To draw near the rules of these marketplaces we searched for effects of external factors on the outcome of online idea contests. Figure 2 depicts our significant findings, separated by effects on quality and amount of submitted ideas in contests.

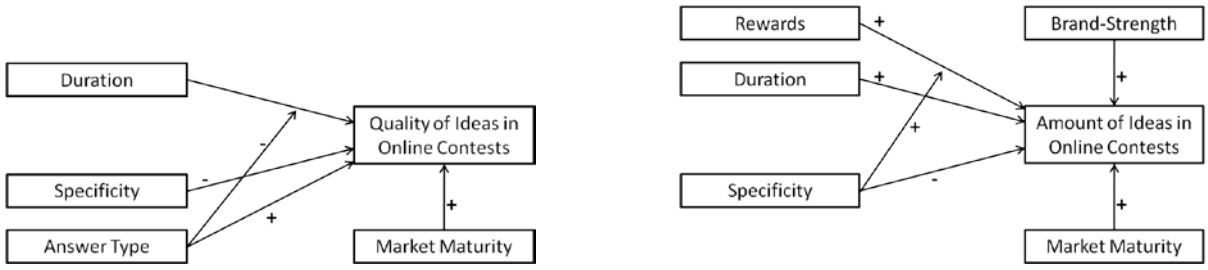

Figure 2 *Effects of external Factors on the average quality of rated ideas and the amount of submitted ideas in online idea contests*

Limitations in space do not allow discussing each result in detail, so we concentrate on major findings. Given the circumstances of an open platform, with less information asymmetries and the asynchronous suggestion process, theory from various research areas is not sufficient to explain effects on online idea contests. Monetary incentives are widely used, but (concerning our dataset) only have an effect on the amount of submitted ideas, not on their quality. Idea marketplace providers as well as seekers should be careful with setting high rewards, as they may cause large amounts of solver submissions, often of lower quality. This could lead toward higher transaction costs (especially for unraveling valuable from useless ideas) and hence, lower the ROI of crowdsourcing. Furthermore the effects of some basic design elements from IS research show no effects on the outcome at all. This includes the task description or partly also the contest duration. In contrast we show the existence of external factors, which can be equal driving forces of the market, but cannot directly be influenced. E.g. when it comes to pure participation, i.e. submitting ideas, solvers are also attracted by the pure existence of a seekers' corresponding brand. Hence, seekers with strong brands may get informed by idea marketplace providers, that it does not need a high reward. In general we find that amount and quality of ideas are affected by different kinds of external factors. For idea marketplace providers this is important to understand. Seekers, trying to incent higher quality of ideas by higher rewards may even create a conflict of goals.

However, there are also limitations to this paper. One is given by a strong finding. We detect a kind of inflationary effect on amount and quality of ideas by the external factor of market-maturity. This simply shows that the (perceived) outcome also rises due to the age (i.e. growth) of the idea marketplace. This represents the fact, that more and more potential solvers signed in over time. Future modeling may consider using market growth as a underlying effect. Of course one can also claim that our sample size (74 contests) is rather small. In contrast, variables have been chosen wisely and there is no visible tendency towards multi-collinearity among variables. Another concern is that we were rather selective in choosing the external factors. As chapter 2 suggests, there is a plurality of further factors that may cause effects on the outcome of idea contests. As mentioned, our initial step was to exclude all factors which are directly dependent on solver behavior. Hence, we see a next step in focusing on these factors, especially on effects of the crowd's structure. Social network analysis methodology might be an approach here. To finalize towards a system-theoretical approach research also have to be conducted from a seeker based view. For now, we cannot claim that these external factors can or should be used as driving belts to leverage the outcome, but rather to help all participants better understanding market conditions and being aware of the possible external effects.

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