CESifo
AREA CONFERENCES 2020

Economics of Digitization

Munich, 19–20 November 2020

How Community Managers Affect Online Idea Crowdsourcing Activities

Lars Hornuf and Sabrina Jeworrek

CESifo

CESifo *Working Paper No. 7153*
Category 14: Economics of Digitization

How Community Managers Affect Online Idea Crowdsourcing Activities

Abstract

In this study, we investigate whether and to what extent community managers in online collaborative communities can stimulate community activities through their engagement. Using a novel data set of 22 large online idea crowdsourcing campaigns, we find that moderate but steady manager activities are adequate to enhance community participation. Moreover, we show that appreciation, motivation, and intellectual stimulation by managers are positively associated with community participation but that the effectiveness of these communication strategies depends on the form of participation community managers want to encourage. Finally, the data reveal that community manager activities requiring more effort, such as media file uploads (vs. simple written comments), have a stronger effect on community participation.

JEL-Codes: J210, J220, L860, M210, M540, O310.

Keywords: crowdsourcing, crowdsourced innovation, ideation, managerial attention.

Lars Hornuf
University of Bremen
Faculty of Business Studies and Economics
Wilhelm-Herbst-Str. 5
Germany – 28359 Bremen
hornuf@uni-bremen.de

Sabrina Jeworrek
Halle Institute for Economic Research
Department of Structural Change and Productivity, Kleine Märkerstraße 8
Germany – 06108 Halle (Saale)
sabrina.jeworrek@iwh-halle.de

This version: May 11, 2020
The authors thank Susanne Braun, Jan Marco Leimeister, Lauri Wessel, and the participants of the 1st Crowdworking Symposium (University of Bremen) for their valuable comments and suggestions. They are highly indebted to the managers and owners of the firm that developed the crowdsourced innovation platforms and provided the data. They also thank Gerrit Engelmann and Lana Kupusovic for their research assistance. This article evolved as part of the research project "Crowdsourcing as a new form of organizing labor relations: regulatory requirements and welfare effects," which was supported by the German Research Foundation (*Deutsche Forschungsgemeinschaft*) under grant HO 5296/3-1.

> [M]ost organizations attempting to receive suggestions from external contributors will not be successful in doing so (Dahlander and Piezunka 2014, p. 825).

> Managers establish and modify the direction and the boundaries within which effective, improvised, self-organized solutions can evolve [and] tune the system by altering the constraints (Andreson 1999, p. 228).

Introduction

To remain competitive, firms are under constant pressure to generate innovations. Traditionally, firms have managed innovations within their own boundaries through hierarchical governance mechanisms, which have long been deemed superior to market-based mechanisms, in part because they are more efficient in reducing transaction costs arising from coordination problems (Sawhney and Prandelli 2000). Market-based mechanisms, however, foster creativity and reduce the risk of path dependence in innovation management. The development of open source software provides an often-cited example in the literature (e.g., the Linux operating system, the Apache web server software)—products were successfully developed largely without a hierarchical governance structure and formal coordination mechanism (Foss et al. 2016). Thus, relying on an online community can constitute a competitive advantage for a firm that intends to generate innovations (Jeppesen and Frederiksen 2006). In recent years, not only have online communities grown in size and scope, but academic interest in these communities has also gained momentum (Faraj et al. 2016).

In online idea crowdsourcing, commercial companies expose a group of individuals with diverse views and skills to a problem-solving task. In general, such collaborative online communities are complex organizational systems because they involve many individuals that interact in a complex way (Foss et al. 2016). Typically, complex systems are managed by some form of hierarchy. In the absence of hierarchical governance mechanisms, open-source software development and online idea crowdsourcing platforms often decompose the respective problem into easier-to-address subproblems to enable users to solve these problems. Moreover, in practice, many online idea crowdsourcing platforms have market-based as well as hierarchical features build in. One of these hierarchical features is the institution of a community manager who coordinates and supports the innovation efforts of the crowd. However, little empirical research has investigated the activities and effectiveness of community managers on online idea crowdsourcing platforms. Chen et al. (2012) provide anecdotal evidence of the importance of community managers by showing that the change of the official Dell IdeaStorm manager led to a noticeable spike in participation. In this paper, we

systematically investigate not only *whether* community managers elicit community participation but also *how* they should ideally behave to foster online idea creation. We consider this an important research question, as empirical research on open source software development has shown that many projects suffer an early death (Stewart et al. 2006) and that sustaining an initial community engagement level is important (von Briel and Recker 2017).

Extant research on the crowdsourcing of ideas has analyzed user motivation, investigating why users participate in communities and contribute ideas, often in the absence of a traditional employment relationship and wage payments (Zwass 2010, Faraj et al. 2016). While scant studies have investigated community participation as an output, existing research has mainly focused on the motivation for participating in open source software projects (Hann et al. 2002, Hars and Ou 2002). These articles find that the signaling of competence through, for example, a higher status in a merit-based ranking and future rewards in terms of human capital are important factors for software developers to contribute to an open source software project. Other factors motivating individual contributions to an online community fall under three broad categories (Faraj et al. 2016).

First, users often exhibit economically driven extrinsic motives, such as receiving support on their own software problems or obtaining resources such as music or movies by sharing their resources in peer-to-peer networks (Chen et al. 2012, Ray et al. 2014). In particular, the extent to which participation in online communities affects career prospects and social capital can also play a decisive role in contribution decisions (Lerner and Tiróle 2002, Wasko and Faraj 2005).

Second, in the absence of traditional employee rewards such as a higher wage or promotions, psychologically based intrinsic motives play a decisive role. Intrinsic motivation might be particularly important if community members lack a clearly articulated identity (Boons et al. 2015) because such an identity could, for example, be recognized in a merit-based ranking. Early studies have identified the satisfaction of participants' needs (Franke and von Hippel 2003, Lakhani and von Hippel 2003), the pleasure of participation (Füller et al. 2007), and the joy of helping others (Kankanhalli et al. 2005) as important factors to participate in an online community. Suggestions from external contributors can accelerate product development and innovation (Eisenhardt 1989, Chesbrough et al. 2006). In another early study on voluntary contributions, Jeppesen and Frederiksen (2006) provide survey evidence that feedback by the project initiator was a key motivating factor for individual participation. Chen et al. (2012, p. 168) evidence that in the absence of proper incentive mechanisms, sponsoring companies should focus on a feedback system to keep cocreators engaged. Moon and Sproull (2008) show

that positive feedback increases the duration of participation. Ma and Agrawal (2007) and Spaeth et al. (2015) find that the psychological identification with the online community is a key factor to encourage contributions. Community members are also driven by the opportunity to learn (Lakhani and Wolf 2005) and self-efficacy goals (Ray et al. 2014).

Third, the repeated nature of interactions in online communities often leads to the emergence of social structures. As such, many scholars have argued that sociologically driven prosocial motives play a role in participation decisions. Stewart and Gosain (2006) find that a specific ideology among contributors fosters trust within the community and thus encourages contributing behavior; however, such trust can often be fragile and temporal in global and virtual communities (Jarvenpaa and Leidner 1999). Sponsorship by nonmarket organizations and nonrestrictive licenses are also positively associated with contributions by developers (Stewart et al. 2006). In addition, individual identification and a sense of belonging to a group are important factors to participate in a community even in the absence of extrinsic motivators (Hertel et al. 2003, Shah 2006, Fang and Neufeld 2009, Zhang 2010, Boons et al. 2015). Porter and Donthu (2008) indicate that personal beliefs and trust in a community are relevant factors for customers to share information with a community and to develop new products.

While a wealth of research has focused on software development communities, Chen et al. (2012, p. 143) still find a "dearth of in-depth studies on factors or facets that motivate individuals to voluntarily contribute to the idea generation." Chan et al. (2015, p. 42) state that "questions about whether and how customer's online interactions with the firm … influence idea generation behavior remain unanswered." Particularly little attention has been paid to whether the crowd can also be actively managed by a community manager. The research closest to ours is that of Camacho et al. (2019), who investigate how to stimulate ideators' participation in crowdsourced innovation tournaments. They differentiate between positive and negative feedback and find, in stark contrast to Moon and Sproull (2008), that negative feedback has a stronger effect on user participation than positive or no feedback. While laboratory experiments have clear advantages over field data in terms of experimental control and statistical identification, they also come at the disadvantage of external validity. Our study goes beyond the findings of Camacho et al. (2019) in this respect and investigates which activities real community manager actually undertake to activate the community and how the community responds to these activities in terms of participation.

To investigate these research questions, we use a novel data set that allows us to investigate the crowdsourcing of ideas of multiple collaborative online communities. In contrast with previous studies on the crowdsourcing of ideas, we focus on whether and how community

managers can motivate the crowd to participate. The data set covers 22 large-scale campaigns run on two distinct online idea crowdsourcing platforms. We gathered the data from a software vendor that provides white-label crowdsourcing platforms to major international and medium-sized enterprises, among them manufacturing companies from automotive, cosmetics, outdoor, and other sectors. Overall, we find that the engagement of community managers has a positive effect on community activities. More precisely, we observe a pattern that suggests that moderate but steady manager activities (i.e., six to 10 contributions per day) are adequate to enhance community participation. Moreover, we evidence that appreciation, motivation, and intellectual stimulation by managers increase community participation but that the effectiveness of these strategies depends on the form of community participation managers want to encourage. Furthermore, we show that different forms of communication, such as suggestions, comments, and media uploads by the manager, have a differential impact on community participation. Finally, we use different statistical tests to assess the causal relationship between manager engagement and community participation and to prove the robustness of our results.

Our study contributes to extant literature in three ways. First, while most studies examine the type of ideators important for successful idea creation and the factors that lead to the implementation of ideas, we analyze how initiators and operators of a crowdsourcing project can contribute to a successful campaign. In particular, we evaluate the role of the community manager in attracting contributions by the crowd. Second, we investigate not only *whether* community managers elicit community participation but also *how* they should ideally behave to foster online idea creation. Moreover, we provide insights into how the crowd responds to activities by the community manager. Third, we contribute to the literature on the dynamics of crowd behavior. While the dynamics of the crowd have recently been investigated in reward-based crowdfunding (Kuppuswamy and Bayus 2018) and equity crowdfunding (Hornuf and Schwienbacher 2018), the dynamics of online idea creation are largely underresearched. Our study does not, however, contribute to the literature on how to differentiate successful from unsuccessful projects. Such an analysis has been conducted by others and has in the context of open source software been termed a "nebulous concept that may have different meanings across projects and stakeholders" (Stewart et al. 2006, p. 128). However, we argue that generating voluntary input by the crowd is a necessary precondition and, therefore, a key factor for project success (Stewart et al. 2006). Furthermore, the posting of ideas can be "essential for the survival of crowdsourcing communities and firms' profitability" (Chan et al. 2015, p. 44), with the intensity of participation being a critical driver of idea quality (Camacho et al. 2019). Moreover, Keum and See (2017) examine how hierarchy of authority affects the idea

generation versus idea selection phases of the innovation process. They find that hierarchy of authority is detrimental to the idea generation phase of innovation but that hierarchy can be beneficial during the screening or selection phase of innovation.

The structure of this article is as follows: In the next section, we outline the theoretical background and derive testable hypotheses. Thereafter, we describe our data set and explain how online crowdsourcing works on the platforms we analyze. The following section summarizes the empirical results. Finally, we conclude with managerial implications, limitations, and avenues for future research.

Theory and Hypotheses

Online Idea Crowdsourcing

In online crowdsourcing, a group of individuals with diverse views and skills is exposed to a problem-solving task by a commercial company. The company, also referred to as the online crowdsourcing *sponsor*, identifies the problem and posts it on an online crowdsourcing platform. The sponsor can either set up its own platform and define the IT architecture and standards according to which the community is organized (Sawhney and Prandelli 2000) or use an established online crowdsourcing platform such as Amazon Mechanical Turk. In case the sponsor establishes its own platform, it can either program it itself or use a white-label solution by a software vendor. In the latter case, the community might be recruited by the sponsor or the software vendor provides a community from other online crowdsourcing projects previously run on the white-label solution. Furthermore, according to Boudreau and Lakhani (2013), online crowdsourcing can take four different forms: crowd contests, crowd complementors, crowd labor markets, and crowd collaborative communities.

In a *crowd contest*, the sponsor offers a prize, often in the form of cash, and only the winner of the contest receives the prize, with the remaining crowd missing out. Typical examples of crowd contest platforms are HYVE, Tongal, TopCoder, and Kaggle. These platforms are particularly helpful if the sponsor wants to crowdsource a design or software coding problem and needs professional help with community management, intellectual property, and payment issues (Boudreau and Lakhani 2013). Such contests can also take the form of online innovation contests, in which users provide solutions to innovation challenges (von Briel and Recker 2017). *Crowd complementors* create innovations that can serve as complements to the original platform. Well-known examples are applications that can be used in combination with mobile

devices such as phones or tablets. *Crowd labor markets* are markets in which micro tasks, such as the renaming of files or the screening of pictures, are contracted between a sponsor and individual crowd workers. An example of such a crowdworking task is the analysis of satellite images on Amazon Mechanical Turk (Maisonneuve and Chopard 2012). Finally, *crowd collaborative communities* work together to solve a specific problem. In these communities, the platform sometimes coordinates the work of individual members to make online crowdsourcing successful. Online idea crowdsourcing through crowd collaborative communities is often curated by the respective sponsor. Because sponsors have typically not specialized in setting up online crowdsourcing platforms, they often resort to specialized software vendors to create and manage a collaborative community. In the domain of idea crowdsourcing, such communities can operate online and offline and, in the former case, have also been referred to as *private-collective innovation communities* (von Hippel and von Krogh 2003), *community-based innovation communities* (Lakhani and von Hippel 2003), *company sponsored online co-creation brainstorming communities* (Chen et al. 2012), or *online open innovation communities* (von Briel and Recker 2017). Examples of companies that have used collaborative communities are Coty, Ford, IBM, and Lego.

Cash prizes can be awarded to these communities but are not particularly common, because company policies or regulatory concerns prohibit such payments (Chen et al. 2012). Often, these communities rely on some form of intrinsic motivation. Jeppesen and Frederiksen (2006) therefore show that only hobbyists can presume a sufficient level of intrinsic motivation, while professionals will leave the community without any monetary rewards. The online idea crowdsourcing communities we investigate herein fall under the category of crowd collaborative communities. None of the sponsors offered a cash prize, though the software would have theoretically made this possible. The projects we investigate differ in their organization, and in some cases, the community received a toolkit to experiment and test the ideas at home. However, the products delivered were not the final products and did not resemble a perk valued for consumption.

Derivation of Hypotheses

On the online crowdsourcing platform we investigate, community members can post as many ideas—so-called suggestions—as they want and comment on the ideas of other community members. A community manager is charged with screening all user activities.[1] The community

[1] Comments by the community remain on the platform if they contribute in some way to the development of the idea and product. To function effectively, crowd collaborative communities often require a semblance of order and some form of screening mechanism to help eliminate misleading comments (Sawhney and Prandelli 2000).

manager can also post suggestions and comments and thereby encourage the community to become involved. In the terminology of Dahlander and Piezunka (2014), suggestions by the community manager can be a form of "proactive attention," while comments are more a form of "reactive attention."[2] Akcigit et al. (2018) show that getting involved and interacting with others are important because in this way, inventors learn and generate knowledge. Because the attention of the crowd is a scare resource, the community manager plays an important role in online idea crowdsourcing. Research on consumer behavior on the Internet, for example, shows that information on the Internet is often so plentiful that the attention of the community decreases over time (Wu and Huberman 2007, Hodas and Lerman 2013). Attention in online crowdfunding communities therefore often follows an L-shaped pattern (Kuppuswamy and Bayus 2018).

At a traditional workplace, managerial attention can serve as a technology that recognizes worker performance (Halac and Prat 2016). Workers appreciate this attention and reciprocate through higher performance. Jeppesen and Frederiksen (2006, p. 51) indicate that managerial attention has a similar effect in online communities, as users are responsive to "firm recognition," which in their setting means that the firm posted the innovation or related information on its website. In online communities, the manager's recognition is most likely correlated with timely responses to individual suggestions, which can motivate the crowd (Morrison and Bies 1991). Manager suggestions and comments can also be a form of reciprocation by the sponsor (Dahlander and Piezunka 2014). Moreover, information provision by the manager empowers the users to exert more specific and better-informed influence on these suggestions and comments. As a result, comments by the community manager, who takes a moderating role in the online idea crowdsourcing campaign, might attract the attention of the community. Social exchange theory (Blau 1964) argues that leader–member exchanges account for work experiences and ultimately work outcomes. Community managers can act as supervisors in online communities who not only are capable of banning specific contributions or community members but also might motivate the crowd. The technology of digital platforms enables community managers in a unique way to encourage community participation through suggestions, comments, and the provision of media files. In other words, community managers can attract attention and provide valuable resources that help the crowd achieve goals and desirable outcomes in an online community. Chan et al. (2015) argue that feedback on customer ideas generates social benefits for customers and a sense of partnership (Nambisan and Baron

On our platforms, redundant suggestions or comments such as "I had the same idea" are deleted or merged by the manager.

[2] Dahlander and Piezunka (2014) view the *implementation* of suggestions as "reactive attention," while we regard comments by the community manager on previous community suggestions as "reactive attention."

2010). In line with this conjecture, they find that the prior speed of sponsor company feedback on suggestions has a positive effect on the current idea submission rates.

Still, in online communities, the manager's capacity to attract the community's attention might be limited. On the one hand, while engaging with the community can give the community the feeling that the manager appreciates and values member suggestions and comments, his or her engagement with individual suggestions might only have marginal positive returns to the entire community. On the other hand, the community manager can offer so many suggestions and comments that the creative process of the community is severely reduced. Moreover, Keum and See (2017) show that managers might suffer from a bias toward selecting their own ideas while undervaluing the advice or ideas of community members. If community managers behave that way, they may well reduce the incentives of the community to contribute to the idea-generating process. Therefore, community participation might increase with a decreasing rate of community manager engagement. We thus formulate the following hypotheses:

Hypothesis 1a. In online idea crowdsourcing, the community manager's engagement fosters community participation.

Hypothesis 1b. In online idea crowdsourcing, the community manager's engagement fosters community participation at a decreasing rate.

The impact of the community manager on community participation might depend not only on the *extent* of his or her suggestions and comments but also on the *content* of his or her communication. The community manager can take the role of a leader in the online community, with community members acting as followers. As part of their leadership role, community managers have the responsibility to motivate the online community to generate many novel and creative ideas for the development of a product. Leadership research shows that the behavior of a leader is closely related to the creative performance of employees (Martins and Martins 2002, Jaussi and Dionne 2003, Zerfass and Huck 2007). Especially transformational leadership is a relevant predictor of employees' creative performance (Elkins and Keller 2003, Nemanich and Keller 2007, Gumusluoglu and Ilsev 2009).[3] In an early contribution, Sosik et al. (1998) showed that transformational leadership enhances creative ideas and solutions of individuals working in computer-mediated groups.

Transformational leadership stimulates employees intellectually, appreciates proposals, and is directed to supporting and empowering employees (Sosik et al. 1998, Elkins and Keller 2003, Gumusluoglu and Ilsev 2009). This is reflected in the four dimensions characterizing

[3] For a critical assessment, see van Knippenberg and Sitkin (2013).

transformational leadership: (1) *idealized influence*, or leaders' sustainable impact by gaining respect from followers and having high expectations of both followers and themselves; (2) *inspirational motivation*, or articulating an inspiring vision and optimism to followers to achieve goals; (3) *intellectual stimulation*, or stimulating followers to generate creative ideas and new solutions; and (4) *individualized consideration*, or recognizing followers' needs for performance and growth through individual promotion. Regarding the generation of creative suggestions and comments, intellectual stimulation and individualized consideration are key facets of the transformational leadership model (Bass 1985, Judge and Piccolo 2004).

Intellectual stimulation includes leadership behaviors that make employees aware of problems and think about these in new ways (Rafferty and Griffin 2004). Intellectual stimulation helps generate an open and forward-thinking situation within the community and induces members to participate in problem-solving activities (Zhou et al. 2012). Individualized consideration of community members' prior comments or ideas is a form of recognizing their abilities as well as their comments' usefulness, which users might reciprocate by exerting higher efforts and contributing more regularly (Ellingsen and Johannesson 2007, Dur 2009). In this sense, community managers can also serve as *inspirational leaders* that express confidence in and energize the community (Joshi et al. 2009). However, both these theoretical considerations and the experimental studies confirming the importance of appreciation for work motivation (Bradler et al. 2016, Kirchler and Palan 2018) pertain to traditional work environments and, more important, to a direct employer–employee relationship in which workers respond to the appreciation they have received themselves. Although users might take on the role of an employee (Chan et al. 2010), given the size of some collaborative crowd communities, it is unlikely that a manager can appreciate the contributions of all community members. If members were to view a manager's appreciation as a symbolic award to compete for (Kosfeld and Neckermann 2011), the recognition of one crowdworker could enhance overall participation especially in small communities. Thus:

Hypothesis 2a. In online idea crowdsourcing, community managers' intellectual stimulation is positively associated with a larger number of community suggestions and comments.

Hypothesis 2b. In online idea crowdsourcing, individual consideration by the community manager is positively associated with community participation.

Data and Empirical Specification

Data

We use data on crowdsourced innovation projects initiated by 22 large and medium-sized international companies between 2011 and 2016. The data came from a large idea crowdsourcing software vendor that has developed two similar types of white-label solutions of platforms that differ somewhat in their layout and the type of projects they have attracted but not in their basic software features. Campaigns on platform type 1 (n = 15) differ in product categories, while campaign categories on platform type 2 (n = 7) are rather similar. Projects are split into two types of phases, the so-called suggestion and voting phases. During the suggestion phase, users give suggestions and comments. Suggestions are users' written statements outlining ideas for the respective product. Comments are users' written statements related to other users' suggestions. To better express their ideas, users can also upload media files such as photos or videos. After the suggestion phase, the community commonly votes on the suggestions previously made. In most projects, users are also allowed to make suggestions and to comment during the voting phase. At the end of the voting phase, another suggestion phase can transpire, for example, to further develop or combine previous ideas. The longest-running project covers eight phases (four suggestions phases, each followed by a voting phase). Community managers were installed by the software vendor and did not receive any particular instructions on how to handle the community. They can participate in the same way as users: they can make suggestions or comment, upload media, and vote for the suggestions they like. Furthermore, community managers can inquire about whether suggestions have been fully understood and motivate the crowd to engage in the project.

The data contain detailed information on each activity that was executed during a project phase. From these data, we construct a panel data set by aggregating the activities undertaken on a single day in the course of a particular project. Thus, for each project, we have as many observations as days the project was running. As all kinds of user activities are potentially important for the innovation process, we initially analyze the impact of an actively involved community manager on users' motivation to exert effort by summing up suggestions, comments, and media uploads, which we call the "number of user activities." Given that suggestions, comments, and media uploads, however, might differ substantially in the amount of time that users may need to invest, we also estimate our specifications separately for each category of user activities.

To test our hypotheses, we consider three explanatory variables of interest. First, we construct the *number of manager activities* as we previously did with the number of user activities. Second, we investigate *suggestions*, *comments*, and *media uploads* independently. Third, to measure the *content of community managers' contributions*, we developed a coding system that categorizes the information contained in the comments. In a first step, we generated an initial list of comment categories based on our knowledge and prior research from the transformational leadership literature (Bass 1985, Bass and Riggio 2006). In a second step, we merged similar categories and then developed a system of categories with higher dimensions (Miles and Huberman 1994, Gioia et al. 2012). Our final coding system consists of five categories of manager comments: *appreciation*, *feedback*, *information*, *motivation*, and *intellectual stimulation*.

The category *appreciation* contains community manager comments that value user comments and comments with which the manager attempts to develop a positive relationship with the crowd. If the community manager attempts to clarify suggestions and comments by users or poses a comprehension question, we code this in the category *feedback*. Feedback by the initiators is a key factor in motivating the community (Jeppesen and Frederiksen 2006) and might likewise work for community managers even though they are not identical to project initiators. In case the community manager gives the crowd new information about the product or other product descriptions, we code this in the category *information*. The communication of information is important for the creation, sharing, integration, and application of knowledge (Grant 1996, Kogut and Zander 1992) and encourages the community to participate (Dahlander and Piezunka 2014). The category *motivation* contains comments in which the community manager encourages the crowd to participate or actively asks for help and support, thus potentially triggering joy of helping others (Kankanhalli et al. 2005). *Intellectual stimulation* contains all the manager comments questioning and challenging community members to generate new ideas and write comments. Table A.1 in the Appendix provides a detailed overview of the categories, including examples.

To ensure that our coding system was reliable and coherent, we created detailed explanations for each category. Then, an external researcher not involved in the project initially coded 20% of the activities; this allowed us to ensure that the coding categories were exhaustive and that they had a high degree of objectivity. The interrater reliability using Cohen's kappa indicated good agreement between us and the external researcher (Landis and Koch 1977, Fleiss et al. 2003). To achieve even greater consistency in the coding, we discussed the coding system with the external researcher and adapted it when necessary. Afterward, we again coded all 100 suggestions and 2,241 comments and conducted another interrater reliability analysis to ensure

coding consistency between us. Cohen's kappa was 0.832, indicating good to excellent agreement between us and the external researcher. Finally, we decided to qualify only comments that were in line with the respective category, if both researchers agreed that a comment belonged to the respective category.

Empirical Specification

To identify the effect of the community manager on community participation, we use an approach similar to Chen et al. (2012) and Dahlander and Piezunka (2014) and examine the number of community activities—suggestions, comments, and media uploads—in an online idea crowdsourcing campaign on a given day. Given that our dependent variable consists of count data, we decided in favor of a fixed-effects Poisson model that can exploit the panel structure of our data and remove any unobserved, time-invariant heterogeneity for a particular idea crowdsourcing project. For example, the project initiator, the project purpose, potential rewards, or the personal characteristics of the community manager will be differenced out.

Jeppesen and Frederiksen (2006) provide first evidence that peer recognition is less important while firm recognition matters most. Chen et al.'s (2012) more recent study finds that prior levels of peer feedback have a positive effect on idea submission rates, because participants who receive more feedback appreciate the gain in reputation and a higher level of popularity. That is, firm recognition already encompasses to some extent peer recognition, in that firm recognition is made openly in front of the community. Receiving feedback can also be considered a positive signal by individuals posting suggestions and thus encourages them to participate further. Finally, because community members can respond to other contributions and given the potential herding behavior of the crowd in other domains such as crowdfunding (Kuppuswamy and Bayus 2018), it seems reasonable to take the previous activity of the community into account by controlling for both user and manager activities at $t - 1$ and $t - 2$. The inclusion of the lagged number of contributions as control variable results in the loss of 84 observations.[4]

In addition, we consider dummies for weekdays, as the crowd might have more time and be more motivated to support a project during the weekend. We also include dummy variables for each decile of the total project length, separated for three different types of projects (projects

[4] As a robustness check, we substituted the lagged missing values with a value of 0. The reported results remain qualitatively and quantitatively the same.

up to one month, up to two months, and longer than two months). This approach is in line with Hornuf and Schwienbacher (2018) and Kuppuswamy and Bayus (2018), who include a vector of dummies indicating the first and last seven days of the campaign cycle to capture differences in contribution behavior across the project cycle. Similarly, we also include a vector of dummies indicating which suggestion phase out of a maximum of four phases the project is in currently.

Results

Descriptive Statistics

The 22 projects in our study cover 910 days of suggestion phases.[5] The project length varies between 16 to 127 days, and its average is 72.04 days (SD = 31.53). The number of active users (i.e., those who wrote suggestions and comments or uploaded media) varies from 16 users to 873 users per project. In 72.7% of the projects, there are two suggestion phases, each followed by a voting phase. The average length of a suggestion phase is 19.17 days.

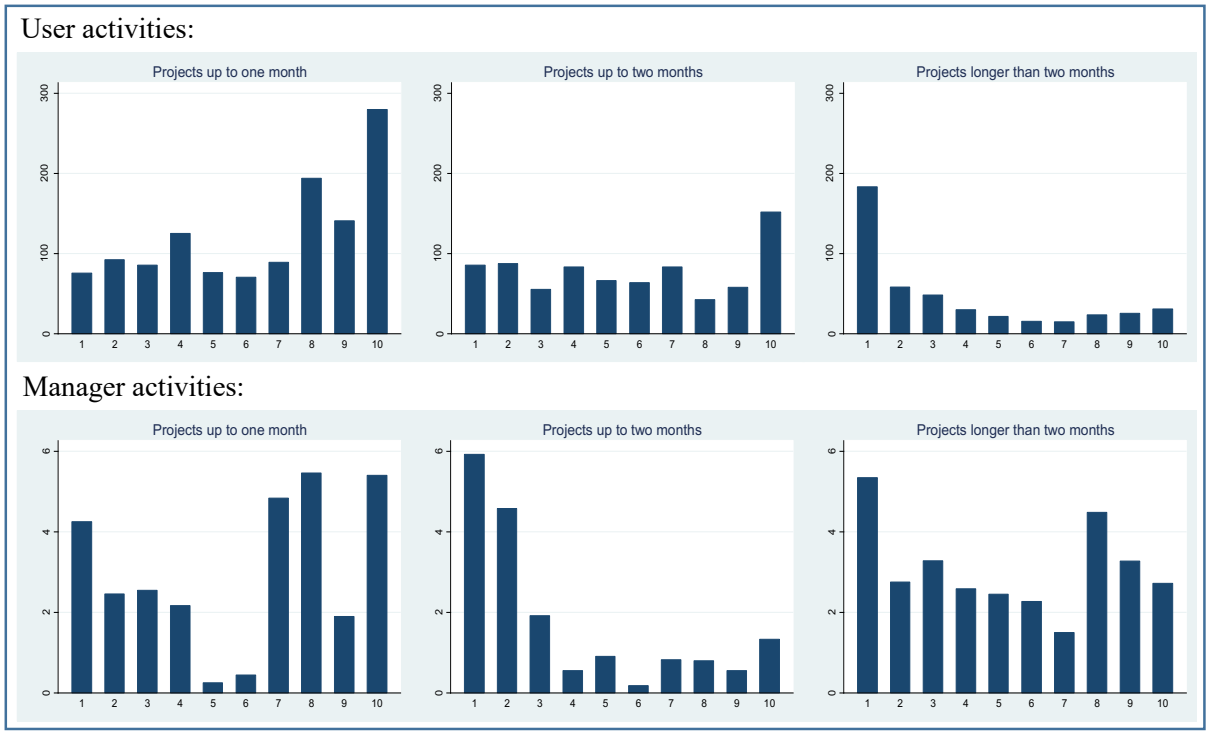
Across all projects, we observe 34,378 comments, 17,599 suggestions, and 9,412 media uploads. Similar to the project length and the number of active users, the number of user activities differs substantially between the single projects (for details, see Table A.2 in the Appendix). Manager activities add up to 2,241 comments, 100 suggestions, and 108 media uploads. We find that managers are inactive in 66.4% of campaign days. Conditional on being active at least once per day, the average number of manager activities is 7.77 (SD = 12.00).

So far, research has paid relatively little attention to the dynamics of online communities (Foss et al. 2016). Figure 1 illustrates the distribution of both user and manager activities over the course of a project (in deciles of total project length) for short projects that last up to one month, projects of medium length with up to two months, and long-running projects with a project period of more than two months. The first two categories show a similar pattern of user activities with rather stable but low-level contributions at the beginning of the project and an increase in activities at the end, which suggests that users accumulate experience and might

[5] Although users are still allowed to suggest, comment, and upload media during voting phases, we observe only 1,641 activities in such phases, which is less than 3% of the overall user activities. These numbers show that the main idea of a voting phase is indeed to vote. Thus, we exclude voting phases from our analysis.

better understand their role community over time (Chan et al. 2015). Alternatively, they might engage in some form of sniping and use their last chance to contribute to the project. However, the opposite is true for long-running projects, which is in line with earlier findings from the Dell IdeaStorm community (Chen et al. 2012). Given that users know how long a project is running, they might anticipate that they will not contribute over the whole time horizon and exert their efforts only at the beginning. These different patterns make it necessary to control for each decile of each of the three categories in our econometric analysis.

Figure 1. Distribution of Activities by Project Length



Dahlander and Piezunka (2014, p. 815) conjecture that the more suggestions are submitted over time, the more self-sustainable the communication among community members becomes and the more the effectiveness of sponsor contributions diminishes. Comparing the campaign patterns of users and managers, the descriptive statistics suggest that active community managers do not induce more user contributions. However, we find that the average number of user activities is 30.54 per day if no manager is active, whereas this number rises to 116.43 user contributions if the manager is active at least once during that day. Thus, given the limited number of manager activities per day, the data suggest a nonlinear relationship between manager and user activities, which we investigate further in the following subsection.

Community Manager Impact on User Contributions

Table 1 reports incidence rate ratios obtained from regression analyses that reveal the impact of community managers on user activities. In specification (1), one additional manager activity on a given day is associated with a 1.6% increase in overall user activities. To take into account that user activities might also be a response to manager activities on the previous days, or other users' activities, we include lags of these variables in specification (2). Indeed, the point estimate for the number of manager activities on the focal day shrinks to 1.2% but stays highly significant.[6] The point estimates for the lagged manager activities are around half the size, which suggests that active community managers have a lasting impact on user contributions.[7]

In line with Nambisan and Baron (2010) and Wasko and Faraj (2005), we find that past participation triggers future participation. User activities are positively associated with the number of user contributions on the previous day, but this relationship vanishes when considering the user activities the day before the previous day. Furthermore, it could be argued that the community manager's impact depends on the number of suggestion phases a project has; during the fourth suggestion phase, for example, users could be less motivated. Manager activities might then even be more important to motivate users to exert effort. Adding interaction terms between the project phase and manager activities in specification (3), however, does not support the conjecture that manager activities have a differential impact on community activities over time. There is no statistically significant difference of the managers' impact between the four possible suggestion phases.

[6] This finding is not driven by the reduced sample size (due the inclusion of lagged variables); reestimating specification (1) with this reduced sample results in almost the same point estimate.
[7] When adding a third lag of user and manager activities, the model no longer converges.

Table 1. Main Regression Results

Dependent variable	All user activities			Suggestions only			Comments only			Media only	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Manager activities $_{t}$	1.016***	1.012***	1.012***	1.018***	1.014***	1.012***	1.015***	1.013***	1.013***	1.001	1.002
	(0.004)	(0.002)	(0.002)	(0.005)	(0.003)	(0.005)	(0.004)	(0.002)	(0.002)	(0.004)	(0.003)
Manager activities $_{(t-1)}$	--	1.006**	1.006**	--	1.008	1.008*	--	1.005**	1.005**	--	1.000
		(0.002)	(0.002)		(0.005)	(0.005)		(0.002)	(0.002)		(0.007)
Manager activities $_{(t-2)}$	--	1.006***	1.006***	--	1.007	1.008*	--	1.007***	1.007***	--	--
		(0.002)	(0.002)		(0.004)	(0.004)		(0.002)	(0.002)		
User activities $_{(t-1)}$	--	1.001***	1.001***	--	1.001**	1.001**	--	1.002***	1.002***	--	1.001*
		(0.0003)	(0.0003)		(0.0003)	(0.0004)		(0.0002)	(0.0002)		(0.001)
User activities $_{(t-2)}$	--	1.0002	1.0001	--	1.00003	1.0009	--	1.0001	1.0001	--	--
		(0.0002)	(0.0002)		(0.0002)	(0.0002)		(0.0003)	(0.0003)		
Manager activities$_t$ × 2nd suggestion phase	--	--	0.997	--	--	0.981	--	--	1.004	--	--
			(0.009)			(0.012)			(0.009)		
Manager activities$_t$ × 3rd suggestion phase	--	--	1.010	--	--	1.028***	--	--	0.994	--	--
			(0.010)			(0.011)			(0.013)		
Manager activities$_t$ × 4th suggestion phase	--	--	0.994	--	--	1.019	--	--	0.982***	--	--
			(0.007)			(0.012)			(0.007)		
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	910	826	826	910	826	826	910	826	826	747	715
Wald χ^2	1482.68	44638.44	44208.79	6449.92	2047.01	650.84	12573.76	24068.18	46815.10	1.19e+06	17.426.95
Prob > χ^2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes. The table reports incidence rate ratios (IRRs) obtained from fixed-effects Poisson regressions (robust standard errors in parentheses). Control variables include dummies for the day of the week, deciles of the total project length for three different types of projects (i.e., projects up to one month, up to two months, and longer than two months), and the suggestion phase (i.e., one to four). Significance levels are denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. For media uploads as the dependent variable, groups are dropped because of all zero outcomes.

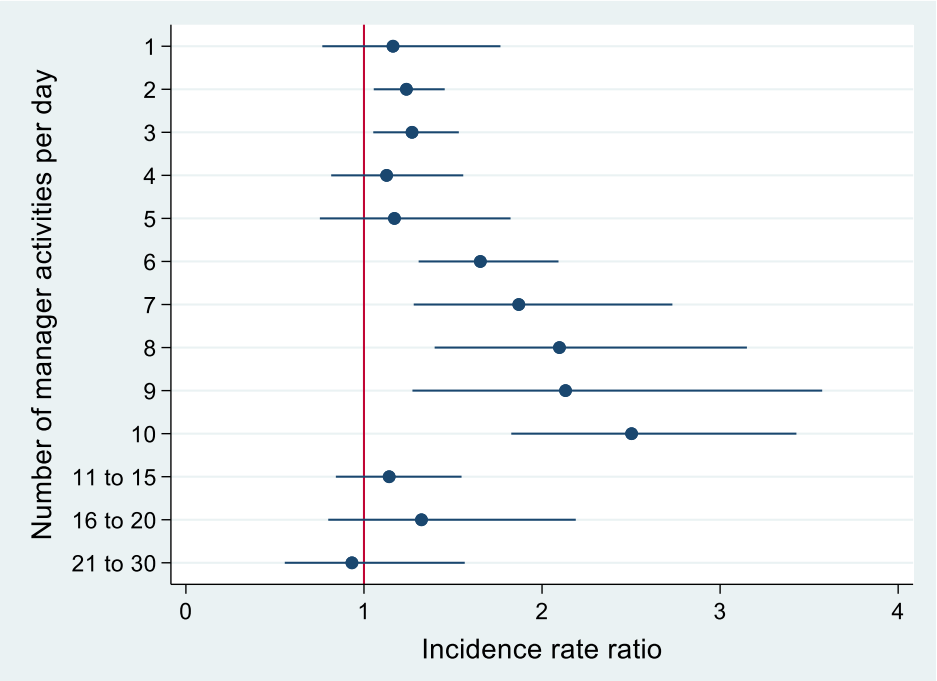
Given that a suggestion might be more valuable than a comment for the innovation process, we reestimated specifications (1) to (3) separately for users' suggestions, comments, and media uploads (with some limitations for the latter due to a smaller sample size, because some projects do not contain any media uploads). Table 1 reports the results. For suggestions only, the point estimate for managers' activities is at least as high as in the previous specifications, though lagged manager activities no longer have a significant effect on community activities. In contrast with the previous results, specification (6) suggests that a manager's impact indeed increases in later suggestion phases. Although only suggestion phase 3 is significantly different from the reference category (i.e., suggestion phase 1), the point estimate for suggestion phase 4 is also positive, and the nonsignificance might be explained by a lack in statistical power, as only two of the 22 projects have a fourth suggestion phase. Whereas managers' impact on users' commenting activities in suggestion phases 1 and 2 is nearly identical for overall user activities and suggestions only, there seems to be a slightly negative trend over the project life cycle, as the interaction term with phase 4 is significantly negative. For media uploads, we do not find any statistically significant relationship to the number of manager activities on a given day, but similar to all other specifications, the number of media uploads slightly increases with the number of user activities on the previous day.

Although it is impossible to judge the quality of each contribution, the longer a comment or suggestion is, the more elaborated the user's thoughts might be. To investigate whether the increasing quantity of contributions is not at the expense of their quality, we consider the total length of suggestions and comments. Following with Dahlander and Piezunka (2014), we use the number of words as a proxy for the elaborateness of user activities. The resulting IRRs are nearly identical to the results obtained using the number of contributions as the dependent variable (see Table A.3 in the Appendix). Thus, the data strongly support Hypothesis 1a that a community manager fosters community activities.

The 1.2% increase in user activities from Table 1 seems small when we compare it with the IRRs obtained when substituting the number of manager activities with a dummy variable for whether a manager was active on a given day or not. We find that when a community manager is active at least once per day, the total number of user activities increases by approximately 42% ($p = 0.005$) compared with days without any manager activities (for details, see Table A.4 in the Appendix). In contrast with the previous results, we also observe a statistically significant impact on community media uploads of slightly more than 27% ($p = 0.005$). Thus, we estimate

IRRs separately for different numbers of manager activities per day to check the possibility of a nonlinear relationship between the number of manager and user activities. Figure 2 depicts the results.

Figure 2. Impact of Additional Manager Activities on User Activities



Notes. The estimates are based on specification (2) from Table 1. Given low numbers of observations, we clustered days with 11 to 15, 16 to 20, and 21 to 30 manager activities on a given day. Observations with more than 30 manager activities per day are dropped (i.e., nine observations).

Although two and three manager activities per day are statistically significant, Figure 2 shows that a slightly larger number of activities (i.e., six to 10) has a considerably stronger effect. Notably, more than 10 manager activities per day no longer seems to have an effect. Some users might not find a benefit in contributing to the community if the manager is already "doing his or her job." Another explanation might be found in our data set: we only have 41 observations that cover 11 to 30 manager activities per day. Thus, these results should be taken with care, as we might lack the statistical power to identify a significant relationship, if existent. Nevertheless, it seems reasonable to conclude that it is important for community managers to be active on as many days during the campaign as possible with a moderate activity level rather than being active on only a few days with a rather high activity level, in support of Hypothesis 1b.

Impact of Community Manager Communication Mode and Content on User Activities

After establishing a strong and robust impact of community manager contributions on user activities in general, we investigate whether the type of contribution and the concrete content of suggestions and comments play a role in user activities. As the *Data* section outlines, both managers and users can contribute suggestions, comments, and media uploads. Given that uploading media might generate more attention in the community than posting a comment, the different categories could have a differential impact on user activities. Therefore, we repeat the previous analyses but split managers' activities into the three different forms of communication. Given the nonlinear relationship between manager and user activities and the low variation in manager suggestions and media, we use binary variables for the managers' activities only. Table 2 presents the results.

Table 2. Differences among Suggestions, Comments, and Media Uploads

	(1)	(2)	(3)	(4)
Dependent variable	All user activities	suggestions only	comments only	Media only
Manager suggestions$_t$ (yes/no)	1.436** (0.226)	1.925*** (0.186)	1.253 (0.226)	2.009 (1.184)
Manager comments$_t$ (yes/no)	1.302** (0.136)	1.435** (0.218)	1.241** (0.128)	1.223** (0.112)
Manager media upload$_t$ (yes/no)	2.059*** (0.541)	2.099** (0.779)	2.323*** (0.389)	1.045 (0.229)
Observations	871	871	871	715
Wald χ^2	14641.81	883.93	10545.61	125153.51
Prob > χ^2	0.000	0.000	0.000	0.000

Notes. The table reports IRRs obtained from fixed-effects Poisson regressions (robust standard errors in parentheses). Additional controls are identical to the specifications (2), (5), (8), and (11) in Table 1. However, we refrain from controlling for user and manager activities at t – 2, because a substantial fraction of community manager suggestions and media uploads are observed in the beginning of a suggestion phase. Significance levels are denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

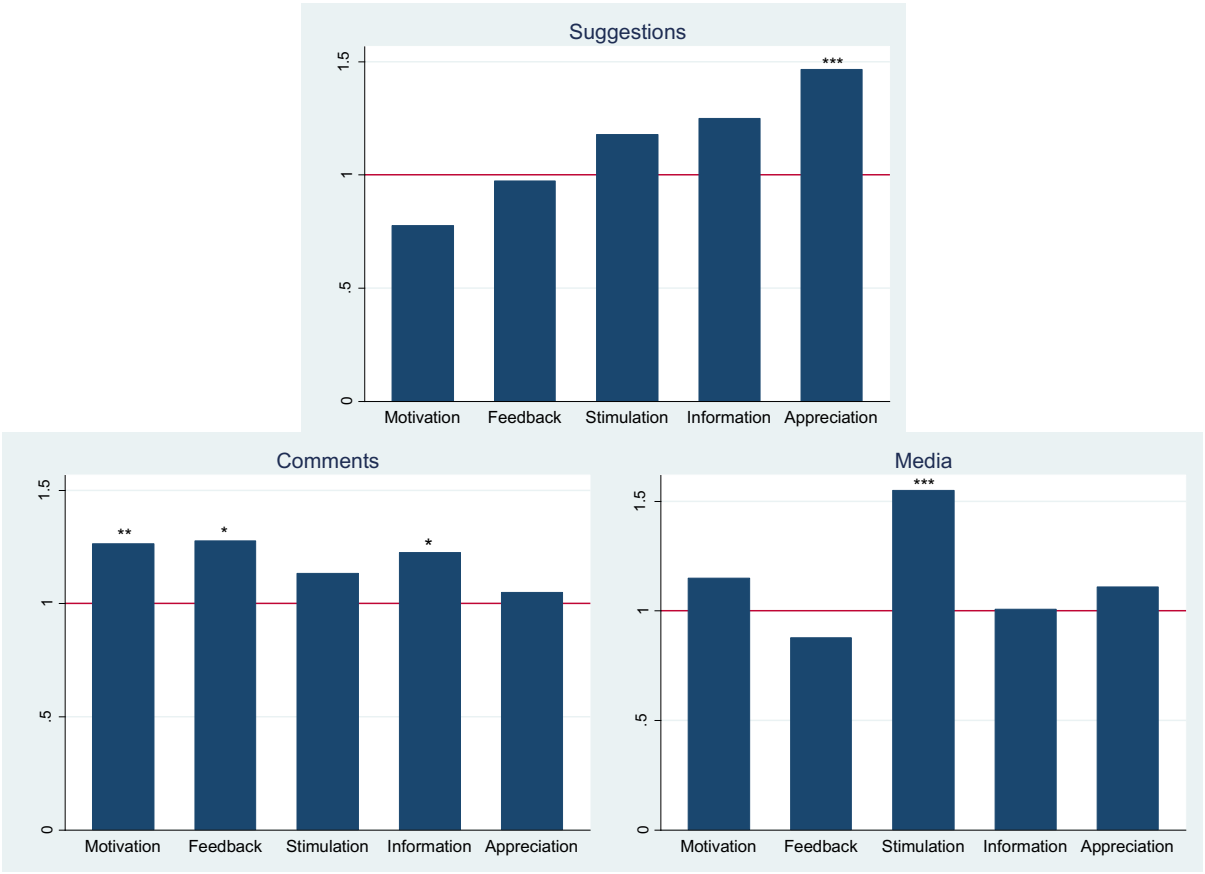
Manager comments are consistently estimated to have a positive impact on all types of user activities, with the largest point estimate for suggestions. The low numbers of manager suggestions and media uploads mean that the remaining results should be taken with some care, but notably, manager suggestions seem to be followed by user suggestions and media uploads (compared with user suggestions, the IRR is similar in size but nonsignificant), whereas the point estimate in case of user comments is much lower. A possible explanation for this finding is that though users might hesitate to comment on a manager's suggestions, these suggestions raise the motivation of the community to come up with a similarly good or even better idea

than the manager's. Furthermore, we find that managers' media uploads are strongly associated with user comments and suggestions. However, media uploads do not seem to motivate users to upload media themselves—which might be in line with the prior suggestion that users do not exert effort if the manager has already done the job.

Next, we analyze the content of managers' suggestions and comments as outlined in the *Data* section. We observe that managers inform the community members about the latest developments of the project or the product itself in 78.1% of all project days on which the manager is active. Community managers are similarly active in valuing user suggestions and comments (75.6%) and are only slightly less active in stimulating suggestions and comments (68.3%). Suggestions and comments coded in the categories feedback and motivation appear infrequently (13.3% and 15.6%, respectively).

Figure 3 shows significantly different patterns for the three types of user activities. Strikingly, only managers' appreciation seems to be related to the number of community suggestions. Given that participation in these communities is not paid for, our results suggest that users' primary incentive to participate might be to receive some sort of appreciation from the community manager, which could indirectly also enhance their status within the community. Regarding community comments, we find a positive association with community manager motivation, feedback, and information, even though the latter two are only marginally significant. For community media uploads, which probably require the most creativity, manager stimulation is important. Thus, managers are right to provide users with appreciation and intellectual stimulation and to engage in motivational activities, but they should also consider giving feedback and provide users with information. Which of these five categories work best to stimulate community activities depends on the respective form of communication managers want to encourage. Taken together, our results provide support for both Hypothesis 2a and Hypothesis 2b, in that intellectual stimulation and individual consideration are positively associated with the activity of the community, but community manager feedback, motivation, and information should also not be neglected.

Figure 3. Content of Manager Activities



Notes. Estimations are based on the same specifications as depicted in Table 2, but instead of splitting manager activities into suggestions, comments, and media uploads, we split them into the five content categories. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Causality

Given the observational nature of our data, it could be argued that our results suffer from reverse causality, in that the positive relationship between community manager and user activities is due to managers responding to the activities of the crowd, not vice versa. Although we cannot rule this suggestion out completely, the following findings suggest the opposite. First, with the exceptions of specifications (1), (4), (7), and (10), all specifications include lagged variables for manager activities on the previous day. Because user contributions on the current day cannot influence manager engagement from the previous day and we still find highly significant IRRs for these lagged variables in the majority of specifications, the positive relationship between manager and user contributions cannot entirely be driven by user activities causing the manager to respond. Second, the positive relationship between manager appreciation and user suggestions might speak in favor of reverse causality, as a more active crowd generates more opportunities for managers to recognize users' contributions, but this

line of argument should not be true for manager stimulation and users' media uploads: if there are already quite a few uploads, there will be less need for managers to stimulate the crowd.

Furthermore, we restricted our analysis to a sample that is the most unlikely to suffer from reverse causality. This sample covers only seven of the 22 projects, but these are special because the average daytime of manager activities is at least one hour earlier than the average daytime of user activities. Moreover, we dropped days with a high number of user activities on the previous day (more than 10 user activities), so that early manager activities are unlikely to be a response to user activities on the previous day. In this analysis, we end up with 118 days of observations and an estimated IRR of 1.011 ($p = 0.006$) for the total number of manager activities and an estimated IRR of 1.524 ($p = 0.034$) for a manager being active at least once per day.[8] Some manager activities are clearly a response to users' activities, and we cannot guarantee that these trigger user activity; however, if the conjecture were true that manager activities are *only* a response to user activities, the estimated IRRs for this specific sample would be significantly lower than the IRRs for the overall sample, which is not the case.

Finally, we also used propensity score matching to test for the robustness of our results. Considering the idea that a high number of community activities on the previous day increases the likelihood of a manager being active, we compare only the days on which managers have the same likelihood of being active by matching one observation from our artificial treatment group (i.e., a day on which a manager was active) with one control group observation when no manager was active that day. Following Rosenbaum and Rubin (1983), we consider only the observation that has the closest propensity score. In addition, the propensity scores of two matched observations are required to be below the predefined caliper of 0.01. In this simple model in which we match the number of user and manager activities on the previous day only (model 1), the sample size shrinks to 470 days of observation, but the density distributions of propensity scores and the biases before and after matching (see Appendix, Figure A.1) show almost perfect alignment of these two covariates. In model 2, we also differentiate among suggestions, comments, and media uploads. In model 3, which is the most extensive, we match on the covariates used in our baseline regression, again only with the exception of the deciles of project length due to the low sample size. Although the alignment of covariates is not perfect, especially in comparison with the other two models, none of the covariates significantly differ between our control and treatment observations anymore. Table 3 summarizes the results obtained from all three models. Compared with the pure descriptive statistics, which suggest a considerable impact of a manager being active at least once per day (30.54 vs. 116.43 user

[8] Compared with our baseline regressions, we refrained from controlling for the deciles of total project length because of the low sample size.

activities), the differences between the control and artificial treatment observations are somewhat smaller but still sizable and statistically significant. Taken together, our findings are unlikely to be due to reverse causality.

Table 3. PSM Results

Model	Av. user activities Control	Av. user activities Treatment	*p*-value	Estimated IRR	*N*
1	51.68	76.83	0.002	1.487***	470
2	54.00	71.58	0.002	1.325***	458
3	59.92	80.44	0.049	1.345***	416

Notes. Matching procedure is based on the following variables:
Model 1: User and manager activities (t – 1).
Model 2: User and manager suggestions, comments, and media uploads (t – 1).
Model 3: User and manager activities (t – 1 and t – 2), day of the week, and suggestion phase.

Discussion

Managerial Implications

In this research, we investigated online idea crowdsourcing, which is a more permeable form of innovation creation than traditional forms of innovation management. Our empirical analysis extends previous research on crowdsourced innovation (Moon and Sproull 2008, Camacho et al. 2019), which has largely focused on individual motives to participate in online innovation projects and the likelihood of idea implementation, by analyzing the role of the community manager in community participation. Using a novel data set from a large crowdsourcing software vendor, we find that managers should optimally be present on a regular basis but not to a maximum extent. Moreover, managers are well-advised to stimulate community members intellectually, to appreciate their suggestions, and to provide relevant information about the project. Even managers' own suggestions have a positive impact on user suggestions because they raise the motivation of the community to come up with a similarly good or even better idea than the manager.

In a traditional workplace, resources provided by managers include augmented communication, clearly defined roles, the fostering of workers' self-esteem, increased knowledge, and the provision of social support (Liden et al. 1997, Mueller and Lee 2002). While Jeppesen and Frederiksen (2006, p. 57) conclude that participation and innovation in online communities "are related to the wish of being recognized by the firm hosting the user community," we find that recognition is positively associated with user suggestions, but not

with other forms of user activities. Raban et al. (2010) provide empirical evidence that projects can fail if they cannot attract the critical mass of users and user activities for the community to become self-sustaining. In general, our data suggest that community managers play an essential role in fostering community participation and that the management of communities is in many ways similar to the management of teams in hierarchically structured firms. This is a notable finding given that, for example, the importance of appreciation for work motivation (Bradler and Neckermann 2016, Kirchler and Palan 2018) involves a direct employer–employee relationship, which is mostly absent in large online communities. If the project initiator is neither able nor willing to communicate with the community (von Briel and Recker 2017), project initiators need to resort to help from the market. As in our case, software vendors hosting the communities might be willing to provide a professional community manager, or alternatively an experienced community manager should be hired from another platform.

Successful value creation in online communities requires active engagement by participants (Barrett et al. 2016, Bauer et al. 2016). A key challenge for crowdsourcing sponsors is to foster creative ideas without extrinsic and, in particular, monetary incentives, to motivate individuals to participate and cooperate within the community. Fredberg and Piller (2011) find that even users with strong ties to the firm are not willing to contribute to innovation activities per se. As a result, firms have created new service centers that handle conversations with customers. Kozinets (1999) suggests that firms need to involve their customers to lead their user communities. Our results indicate that a community manager can also come from outside the firm to handle the community effectively. Therefore, having a good support process installed and knowing how a specific community can be motivated are important for community managers in online idea crowdsourcing. Software vendors and project initiators might thus develop best-practice handbooks or online tools that outline how to handle communities best.

Limitations

In contrast with many related studies (e.g., Chen et al. 2012), our analysis does not rely on a single community or project. Thus, our empirical analysis offers greater external validity. Still, our results might not be generalizable to other types of communities, such as crowd complementors or crowd labor markets. Moreover, while our study is broad in terms of the projects we consider, we clearly lack detail on the individuals we analyze. Although this does not invalidate the conclusions we derive herein, knowing more about the individuals who

manage the communities would be useful. Do male or female, older or younger, tech or nontech individuals make better community managers? We include campaign fixed effects for this lack of data and to account for time-invariant characteristics of the community managers, such as their age, gender, education, and current ability to manage the community. Furthermore, we also lack information on the personality of individuals who are part of the communities. More information on community members would be valuable with respect to who is more responsive to which type of feedback. In addition, what role does shared values and mutual trust play? Having more information on users would also enable managers to target suggestions and comments more specifically to their needs and wishes.

Our study is obviously limited to users who decided to participate in crowdsourced innovation activities. Thus, our results might not generalize to communities in which managers actively integrate particular employees or customers who would otherwise not have decided to join the community. Furthermore, while our analysis highlights the importance of active community managers, we did not conduct a cost–benefit calculation of such activities. However, given that setting up a community is costly and the innovation development process took an average of 10 weeks in our sample, a back-of-the-envelope calculation would most likely indicate that the benefits still outweigh the costs. However, the larger and the more intense and valuable the community, the more active managers need to be and the higher the administrative costs.

Future Research

The observed patterns regarding the content of managers' activities raise important questions for future research. First, the data suggest that in the communities we study, media uploads by managers have the strongest effect on user suggestions and comments. One interpretation of this result is that users value the effort managers invested in the creation of media files by contributing more actively afterward. However, a media file might also be more visible than a single comment and more effective in the idea-generating process. If more users are aware of a manager's activity, they may also respond to it. Future research should investigate why media uploads by community managers have a stronger impact on community activities than suggestions and comments. Second, we question how the known positive impact of managers' appreciation in a typical workplace transfers to an online setting, whether it depends on the size of the community, and what role privacy preferences of users and managers play. With larger data sets, it will become feasible to provide answers to these questions. Third, future research

might also investigate why community managers behave as they do. For example, von Briel and Recker (2017, p. 41) note that product managers "could still easily process all suggestions [by the community] even if they let them accumulate over time." In other cases, managers replied to community suggestions via private massages, which not only created the impression of users that the firm was not paying attention to them but also deprived the focal user of peer recognition in the form of public acknowledgments of the project initiator. Future research might thus analyze the incentive structure of community managers to better explain their behavior.

References

Akcigit U, Caicedo S, Miguelez E, Stantcheva S, Sterzi V (2018) Dancing with the stars: Innovation through interactions. NBER Working Paper Series 24466.

Barrett M, Oborn E, Orlikowski WJ (2016) Creating value in online communities: The sociomaterial configuring of strategy, platform, and stakeholder engagement. *Information Systems Research* 27(4):704–723.

Bass BM (1985) *Leadership and Performance Beyond Expectations* (Free Press, New York).

Bass BM, Riggio RE (2006) *Transformational Leadership* (Erlbaum, Mahwah, NJ).

Bauer J, Franke N, Tuertscher P (2016) Intellectual property norms in online communities: How user-organized intellectual property regulation supports innovation. *Information Systems Research* 27(4):724-750.

Blau, PM (1964) *Exchange and Power in Social Life* (Wiley, New York).

Boons M, Stam D, Barkema HG (2015) Feelings of pride and respect as drivers of ongoing member activity on crowdsourcing platforms. *Journal of Management Studies* 52(6): 717-741.

Boudreau KJ, Lakhani KR (2013) Using the crowd as an innovation partner. *Harvard Business Review*, 91(4):60-69.

Bradler C, Dur R, Neckermann S, Non A (2016) Employee recognition and performance: A field experiment. *Management Science* 62(11):3085-3099.

Camacho N, Nam H, Kannan PK, Stremersch S (2019) Tournaments to crowdsource innovation: The role of moderator feedback and participation intensity. *Journal of Marketing*, 83(2):138–157.

Chan KW, Li SY, Zhu JJ (2015) Fostering customer ideation in crowdsourcing community: The role of peer-to-peer and peer-to-firm interactions. *Journal of Interactive Marketing*, 31:42-62.

Chan KW, Yim CK, Lam SSK (2010) Is customer participation in value creation a double-edged sword? Evidence from professional financial services across cultures. *Journal of Marketing*, 74(3):48–64.

Chen L, Marsden JR, Zhang Z (2012) Theory and analysis of company-sponsored value co-creation. *Journal of Management Information Systems*, 29(2):141-172.

Chesbrough H, Vanhaverbeke W, West J (2006) *Open Innovation: Researching a New Paradigm* (Oxford University Press, Oxford).

Dahlander L, Piezunka M (2014) Open to suggestions: How organizations elicit suggestions through proactive and reactive attention. *Research Policy*, 43(5):812–827.

Dur R (2009) Gift-exchange in the workplace: Money or attention? *Journal of the European Economic Association*, 7(2/3): 550-560.

Eisenhardt KM (1989) Making fast strategic decisions in high-velocity environments. *Academy of Management Journal* 32:543–576.

Elkins T, Keller RT (2003) Leadership in research and development organizations: A literature review and conceptual framework. *The Leadership Quarterly*, 14(4):587-606.

Ellingsen T, Johannesson M (2007) Paying respect. *Journal of Economic Perspectives*, 21(4):135-150.

Fang Y, Neufeld, DJ (2009) Understanding sustained participation in open source software projects. *Journal of Management Information Systems*, 25(4):9-50.

Faraj S, von Krogh G, Monteiro E, Lakhani KR (2016) Online community as space for knowledge flows. *Information Systems Research*, 27(4):668-684.

Fleiss JL, Levin B, Paik MC (2003) *Statistical Methods for Rates and Proportions*, 3rd ed. (Wiley, Hoboken, NJ).

Foss NJ, Frederiksen L, Rullani F (2016) Problem-formulation and problem-solving in self-organized communities: How modes of communication shape project behaviors in the free open source software community. *Strategic Management Journal*, 37(13):2589-2610.

Franke N, von Hippel E (2003) Satisfying heterogeneous user needs via innovation toolkits: The case of Apache security software. *Research Policy*, 32(1):1199-1215.

Fredberg T, Piller FT (2011) The paradox of tie strength in customer relationships for innovation: A longitudinal case study in the sports industry. *R&D Management*, 41(5):470–484.

Füller J, Jawecki G, Mühlbacher H, (2007) Innovation creation by online basketball communities. *Journal of Business Research*, 60(1):60-71.

Gioia DA, Corley KG, Hamilton AL (2012) Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, 16(1):15–31.

Grant RM (1996) Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organization Science*, 7(4):375–387.

Gumusluoglu L, Ilsev A (2009) Transformational leadership, creativity, and organizational innovation. *Journal of Business Research*, 62(4):461-473.

Hann IH, Roberts J, Slaughter SA, Fielding R (2002) Economic incentives for participating in open source software projects. *Proceedings 23rd International Conference on Information Systems*, (ICIS, Atlanta, GA), 365-372.

Hars A, Ou S (2002) Working for free? Motivations for participating open source projects. *International Journal of Electronic Commerce*, 6(3):25-39.

Halac M, Prat A (2016) Managerial attention and worker performance. *American Economic Review*, 106(10):3104-3132.

Hertel G, Niedner S, Herrmann S (2003) Motivation of software developers in open source projects: An Internet-based survey of contributors to the Linux kernel. *Research Policy* 32(7):1159–1177.

Hodas NO, Lerman K (2013) Attention and visibility in an information-rich world. *Proceedings of the 2nd International ICME Workshop on Social Multimedia Research* (IEEE, San Jose, CA), 1-6.

Hornuf L, Schwienbacher A (2018) Market mechanisms and funding dynamics in equity crowdfunding. *Journal of Corporate Finance*, 85:145-162.

Jarvenpaa SL, Leidner DE (1999) Communication and trust in global virtual teams. *Organization Science*, 10(6):791-815.

Jaussi KS, Dionne SD (2003) Leading for creativity: The role of unconventional leader behavior. *The Leadership Quarterly*, 14(4):475-498.

Jeppesen LB, Frederiksen L (2006) Why do users contribute to firm-hosted user communities? The case of computer-controlled music instruments. *Organization Science*, 17(1):45-64.

Joshi A, Lazarova MB, Liao H, (2009) Getting everyone on board: The role of inspirational leadership in geographically dispersed teams, *Organization Science*, 20(1):240-252.

Judge TA, Piccolo RF (2004) Transformational and transactional leadership: A meta-analytic test of their relative validity. *Journal of Applied Psychology*, 89(5):755-768.

Kankanhalli A, Tan BCY, Wei K (2005) Contributing knowledge to electronic knowledge repositories: An empirical investigation. *MIS Quarterly*, 29(1):113–143.

Keum DD, See KE (2017) The influence of hierarchy on idea generation and selection in the innovation process. *Organization Science*, 28(4):653-669.

Kirchler M, Palan S (2018) Immaterial and monetary gifts in economic transactions evidence from the field. *Experimental Economics*, 21:205-230.

Kogut B, Zander U (1992) Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3):383–397.

Kosfeld M, Neckermann S (2011) Getting more work for nothing? Symbolic awards and worker performance. *American Economic Journal: Microeconomics*, 3:1-16.

Kozinets V (1999) E-Tribalized marketing? The strategic implications of virtual communities of consumption, *European Management Journal*, 3:252-264.

Kuppuswamy V, Bayus BL (2018) Crowdfunding creative ideas: The dynamics of project backers. Cumming D, Hornuf L, eds. *The Economics of Crowdfunding: Startups, Portals and Investor Behavior* (Palgrave Macmillan, London), 151-182.

Lakhani K, von Hippel E (2003) How open source software works: "Free" user-to-user assistance. *Research Policy*, 32:923-943.

Lakhani K, Wolf RG (2005) Why hackers do what they do: Understanding motivation and effort in free/open source software projects. Feller J, Fitzgerald B, Hissam S, Lakhani K, eds. *Perspectives on Free and Open Source Software* (MIT Press, Cambridge, MA), 3–22.

Landis JR, Koch GG (1977) The measurement of observer agreement for categorical data. *Biometrics*, 33(1):159–174.

Lerner J, Tiróle J (2002) Some simple economics of open source. *Journal of Industrial Economics*, 50(2):197-234.

Liden RC, Sparrowe RT, Wayne SJ (1997) Leader–member exchange theory: The past and potential for the future. Ferris GR, ed. *Research in Personnel and Human Resource Management*, Vol. 15 (JAI, Greenwich, CT), 47-119.

Ma M, Agarwal R (2007) Through a glass darkly: Information technology design, identity verification, and knowledge contribution in online communities. *Information Systems Research* 18(1):42–67.

Maisonneuve N, Chopard B (2012) Crowdsourcing satellite imagery analysis: Study of parallel and iterative models. Xiao N, Kwan MP, Goodchild M.F, Shekhar S, eds. *Geographic Information Science. GIScience 2012. Lecture Notes in Computer Science*, Vol. 7478 (Springer, Berlin, Heidelberg), 116-131.

Martins E, Martins N (2002) An organisational culture model to promote creativity and innovation. *SA Journal of Industrial Psychology*, 28(4):58-65.

Miles M, Huberman AM (1994) *Qualitative Data Analysis: An Expanded Sourcebook*, 2nd ed. (Sage, Thousand Oaks, CA).

Moon JY, Sproull LS (2008) The role of feedback in managing the Internet-based volunteer work force. *Information Systems Research*, 19(4):494-515.

Morrison EW, Bies, RJ (1991) Impression management in the feedback-seeking process: A literature review and research agenda. *Academy of Management Review*, 16(3):522-541.

Mueller BH, Lee J (2002) Leader–member exchange and organizational communication satisfaction in multiple context. *Journal of Business Communication*, 39:220-244.

Nambisan, Satish and Robert A. Baron (2010) Different roles, different strokes: Organizing virtual customer environments to promote two types of customer contributions. *Organization Science*, 21(2):554–572.

Nemanich LA, Keller RT (2007) Transformational leadership in an acquisition: A field study of employees. *The Leadership Quarterly*, 18(1):49-68.

Porter CE, Donthu N (2008) Cultivating trust and harvesting value in virtual communities. *Management Science*, 54(1):113-128.

Raban DR, Moldovan M, Jones Q (2010) An empirical study of critical mass and online community survival. *Proceedings of the ACM 2010 Conference on Computer Supported Cooperative Work* (Association for Computing Machinery, New York), 71-80.

Rafferty AE, Griffin MA (2004) Dimensions of transformational leadership: Conceptual and empirical extensions. *The Leadership Quarterly*, 15:329-354.

Ray S, Kim SS, Morris JG (2014) The central role of engagement in online communities. *Information Systems Research* 25(3):528–546.

Rosenbaum PR, Rubin DB (1983) The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1):41-55.

Sawhney M, Prandelli, E (2000) Communities of creation: Managing distributed innovation in turbulent markets. *California Management Review* 42(4):24-54.

Shah SK (2006) Motivation, governance, and the viability of hybrid forms in open source software development. *Management Science* 52(7):1000–1014.

Sosik JJ, Kahai SS, Avolio BJ (1998) Transformational leadership and dimensions of creativity: Motivating idea generation in computer-mediated groups. *Creativity Research Journal*, 11(2):111-121.

Spaeth S, von Krogh G, He F (2015) Perceived firm attributes and intrinsic motivation in sponsored open source software projects. *Information Systems Research* 26(1):224-237.

Stewart KJ, Ammeter PA, Maruping LM (2006) Impacts of license choice and organizational sponsorship on user interest and development activity in open source software projects. *Information Systems Research*, 17(2):126-144.

Stewart KJ, Gosain S (2006) The impact of ideology on effective- ness in open source software development teams. *MIS Quarterly*, 30(2):291–314.

van Knippenberg D, Sitkin SB (2013) A critical assessment of charismatic—transformational leadership research: Back to the drawing board? *Academy of Management Annals*, 7(1):1-60.

von Briel F, Recker J (2017) Lessons from a failed implementation of an online open innovation community in an innovative organization. *MIS Quarterly Executive*, 16(1):35-46.

von Hippel E, von Krogh G (2003) Open source software and the "private-collective" innovation model: Issues for organization science. *Organization Science* 14:209-223.

Wasko M, Faraj S (2005) Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly*, 29(1):35-57.

Wu F, Huberman B (2007) Novelty and collective attention, *Proceedings of the National Academy of Sciences*, 104(45):17599-17601.

Zerfass A, Huck, S (2007) Innovation, communication, and leadership: New developments in strategic communication. *International Journal of Strategic Communication*, 1(2):107-122.

Zhang Z (2010) Feeling the sense of community in social networking usage. *IEEE Transactions on Engineering Management*, 57(2):225-239.

Zhou Q, Hirst G, Shipton H (2012) Context matters: Combined influence of participation and intellectual stimulation on the promotion focus–employee creativity relationship. *Journal of Organizational Behavior*, 33(7):894-909.

Zwass, V (2010) Co-creation: Toward a taxonomy and an integrated research perspective. *International Journal of Electronic Commerce*, 15(1):11-48.

Appendix

Table A.1. Definition and Examples of Comment Coding

Coding of comments	Examples
Appreciation: The community manager makes comments that value user suggestions and comments. The community manager attempts to develop a positive relationship with the crowd and highlights the relevance of the comments.	a) "True! We can learn a lot from the thin thermos-materials." b) "Nice pictures :) Thank you for your feedback." c) "Very nice idea, take a picture of the colors with illumination level z!"
Feedback: The community manager attempts to clarify users' suggestions and comments or poses a comprehension question.	a) "You would like to have a tighter, more fitted jacket, if I understand you correctly? What precisely was not right with the fit of the jacket especially at the back part? Can you describe that more precisely?" b) "Dear co-developers! Unfortunately, we must tell you that a two-phase shower cannot be realized till autumn."
Information: The community manager gives the crowd new information about the product or provides product descriptions. The community manager postpones the comment until a later stage of the project.	a) "Hi Monika! You have a great point here. Unfortunately, we only need the concrete theme. On the top left you also see the project overview. Cordially, Moritz" b) "That might be feasibly even without a sliding door. It might be important that the seat at least slightly turn to the outside. Many people move first with their but in the seat and then turn inside the car."
Motivation: The community manager encourages the crowd to participate or actively asks for help.	a) "If you have X-BIONIC clothes at home that you can compare with the tester feedback or if you have questions you may want to ask the testers you can join in on the discussion even if you are not a tester. We would be happy to see you around!" b) "If you have templates that we can upload for you, you can also send them via e-mail to ■■■■■■■@plattform.de."
Intellectual stimulation: The community manager comments by questioning and challenging community members to generate new ideas and write comments. The community manager poses questions about the product development, product name, usage, marketing, and value added of the product.	a) "What kind of chest pocket would you prefer? E.g. size, positioning, zipper etc." b) "Do you have other ideas or needs as to how the jacket could be improved to fit underneath a hard-shell besides the chest pocket?"

Table A.2. Descriptives by Project

				User				Manager			
Project	Length (in weeks)	Suggestion phases	Contributing users	Suggestions	Comments	Media	Votes	Suggestions	Comments	Media	Votes
1	2	1	16	36	36	6	76	0	1	0	7
2	19	3	316	620	927	10	898	4	321	0	122
3	9	3	29	173	1699	1	344	3	30	0	59
4	8	2	51	160	101	0	392	0	130	0	19
5	12	3	404	572	1267	10	539	0	1	0	16
6	9	2	66	368	2136	474	985	0	1	0	8
7	12	3	264	290	362	0	281	1	197	0	21
8	10	2	151	241	281	0	600	10	58	0	18
9	10	2	74	261	1911	727	611	0	140	0	2
10	9	3	364	554	1008	17	608	3	114	0	6
11	10	3	46	141	127	139	143	8	151	0	0
12	3	1	188	214	564	1	167	0	121	0	3
13	6	2	18	32	31	33	0	1	0	0	2
14	11	2	142	405	887	780	488	1	251	0	0
15	7	1	64	280	2139	346	183	0	3	0	3
16	7	4	873	2002	4569	0	4838	17	88	0	235
17	23	4	375	860	6216	1508	5947	25	129	47	318
18	3	1	146	150	125	170	793	1	11	5	81
19	2	1	119	210	114	6	161	3	55	12	62
20	17	2	353	1190	3991	1117	3970	4	284	28	276
21	17	2	681	5186	1946	42	13178	10	5	2	305
22	12	1	401	3654	3941	4019	7981	9	150	14	196

Table A.3. Contribution Length as a Signal of Quality

Dependent variable	Total number of words (1)	Number of words, only suggestions (2)	Number of words, only comments (3)
Manager activities$_t$	1.015***	1.014***	1.012***
	(0.003)	(0.005)	(0.002)
Manager activities$_{(t-1)}$	1.007***	1.005**	1.009***
	(0.002)	(0.002)	(0.002)
Manager activities$_{(t-2)}$	1.008***	1.006**	--
	(0.002)	(0.003)	
User activities$_{(t-1)}$	1.002***	1.001***	1.001***
	(0.000)	(0.000)	(0.001)
User activities$_{(t-2)}$	1.000	1.000	--
	(0.000)	(0.000)	
Additional controls	Yes	Yes	Yes
Observations	826	826	871
Wald χ^2	17065.88	2066.59	5392.29
Prob > χ^2	0.000	0.000	0.000

Notes. The table reports IRRs obtained from fixed-effects Poisson regressions (robust standard errors in parentheses). Control variables include dummies for the day of the week, deciles of the total project length for three different types of projects (i.e., projects up to one month, up to two months, and longer than two months), and the suggestion phase (i.e., one to four). Significance levels are denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Activities$_{(t-2)}$ were excluded from specification (3) because the model no longer converged.

Table A.4. Manager Active at Least Once per Day

Dependent variable	All user activities	Suggestions only	Comments only	Media only
	(1)	(2)	(3)	(4)
Manager active$_t$	1.421***	1.683**	1.372**	1.242**
	(0.178)	(0.346)	(0.172)	(0.117)
Manager active$_{(t-1)}$	1.229**	1.253	1.235**	0.995
	(0.120)	(0.225)	(0.105)	(0.139)
Manager active$_{(t-2)}$	1.157	1.156	1.123	--
	(0.124)	(0.193)	(0.104)	
User activities$_{(t-1)}$	1.001***	1.001**	1.002***	1.001**
	(0.000)	(0.000)	(0.000)	(0.000)
User activities$_{(t-2)}$	1.000	1.000	1.000	--
	(0.000)	(0.000)	(0.000)	
Additional controls	Yes	Yes	Yes	Yes
Observations	826	826	826	715
Wald χ^2	72630.48	794.55	917375.20	127035.70
Prob > χ^2	0.000	0.000	0.000	0.000

Notes. The table reports IRRs obtained from fixed-effects Poisson regressions (robust standard errors in parentheses). Control variables include dummies for the day of the week, deciles of the total project length for three different types of projects (i.e., projects up to one month, up to two months, and longer than two months), and the suggestion phase (i.e., one to four). Significance levels are denoted as follows: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure A.1. PSM Matching Procedure