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## Why Consumers Commit Voluntarily to Collaborative Innovation with Firms by Using Social Media?: Case of Japanese consumers

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# **Why Consumers Commit Voluntarily to Collaborative Innovation with Firms by Using Social Media?: Case of Japanese consumers**

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## **Abstract**

It is necessary to grasp and utilize consumer's needs for firms to improve existing products and developing new products. Especially, collaboration with consumers for product innovation is indispensable. On the other hand, social media has been spreading all over the world. Network communities formed by social media are one of key factors of innovation achieved by collaborating with consumer innovators, which is referred to as consumer collaborative innovation. This paper studies how Japanese firms achieve consumer collaborative innovation based on authors' questionnaire survey data in Japan. In particular, the types of users and the strength of ties between firms and consumers and types of consumer innovators are focused on. In addition, consumers' motivation of collaboration such as the intrinsic and extrinsic motivations of lead users and collaborative innovators are elucidated. This paper finds the role of lead users and pecuniary rewards which are more important than other motivations. Based on results obtained, some measures to promote consumer collaborative innovation in Japan are proposed.

**Keywords:** Consumer collaborative innovation, social media, network community, lead user, motivation, monetary rewards

## **1. Introduction**

Nowadays, to achieve innovation requires establishing networks and collaborations among firms and between firms and customers (Chesbrough, 2003, 2006a, 2006b). In

this type of innovation, one of the most important sources of acquiring external knowledge is users; other firms as customers and consumers (Cohen et al., 2002), in addition to universities and public research institutions which are traditional agents owing new knowledge. Therefore, for commercialization of products, a firm needs to collaborate with these users (Franke and Shah, 2003; Lüthje, 2004; Lüthje et al., 2005; Hyysalo, 2009 ; von Hippel et al., 2011). Especially, in the case of final consumer goods, consumers own ideas or evaluate new products, which are essential for product development. In accordance with the development of ICT, product development in collaboration with users comes to be important more and more.

New development of ICT use is found in social media which has been spreading all over the world. People enable to exchange information through the various network communities based on social media. Social media is useful not only for collecting users' needs and ideas but also for seeking collaborators for product development (Dodgson et al., 2006; Idota, et al., 2015a, 2015b) and consumer collaborative innovation (Dong and Wu, 2015; Oginka and Dong, 2017; Pacauskas et al., 2018). In order to promote collaborative innovation in Japan, social media and network community should be further utilized, which is the target of this paper.

Since the network community is essential for collaborative innovation, as many as members have to commit to collaborative innovation and in so doing, a problem is how to motivate them to participate, that is, what are motivations for them to do so. Based on our questionnaire survey data, this paper studies how to promote consumer collaborative innovation in Japan.

### **1.1 Consumer innovation**

There are three approaches in which users or consumers engage in innovation. The first two are as follows: (i) consumers want to provide information they own to firms which need seeds of innovation; and (ii) firms want to collaborate with customers to make new products. These two are different according to the extent to which customers involve. In (ii), customers can actively involve in testing prototypes, advising product design, and so on. In (i) consumers inform their tastes, needs, or ideas, whereas in (ii) consumers commit in the closer way. The approach of (i) is referred to as passive consumer involvement, while (ii) as active involvement. There is one more approach; consumers themselves improve and make products. von Hippel

(1976) terms this as “user innovation,” which is also referred to as “consumer innovation.” Users can discover various important functions or features of new products in the process of making prototypes, and testing them. Products developed in this way come to be more suitable for user needs. However, this is not sufficient and it is required more refinement before shipping to the market. Firms thus need to commercialize them with users. Although user innovation is a distinctive phenomenon, Japanese firms are not necessarily successful in the international comparison, as von Hippel, Ogawa and De Jong (2011) discovered, based on a large scale international comparison study on user innovation in the US, the UK and Japan. It found that the share of consumer innovators in the population aged 18 and over in Japan is 3.7% (n=2,000); 1.7% of the samples are engaged in creating and 2.5% modifying consumer products. The reason behind this international comparison lies in the cognition of Japanese firms such that products made in such a way by consumers are less qualified and then may not be acceptable in the market.

Contrary to the above observation, innovative Japanese firms already have been utilizing social media as word-of-mouth channels; for example, to discover new ideas and elaborate their concepts through personnel in charge of product development in firms (Idota et al., 2016). This approach is termed by “consumer collaborative innovation,” which emphasizes the collaboration between firms and consumers in the innovation process. This paper aims to analyze further consumer innovation in Japanese firms by focusing on how to collaborate with consumers in the traditional company-led innovation process which is still major in Japan. Therefore, this paper deals with the first and second types of innovations.

## **1.2 Social media and consumer collaborative innovation**

Social media is a series of service for general users to express and share their individual interests, concerns, feelings, experiences, and knowledge (Idota, et al., 2015b). The diffusion of social media has strong influence on the business activities of firms. Firms are required to mobilize all managerial resources and networks to correspond to changes in consumer needs and the market to achieve innovation. Social media greatly improves the ability to obtain and share information, enables to identify new findings from data on a real time basis, and facilitates the sharing of information among various related entities. Information collected by social media is

featured in leading to innovation and then social media became one of the essential bases for promoting innovation (Dodgson et al., 2006; Lee and Xia, 2006; Idota, et al., 2015a, 2015b).

The roles of social media in innovation have been widely discussing in the previous literature. One example is to search lead users in innovation communities (Brem and Bilgram, 2015; Dong and Wu, 2015; Oginka and Dong, 2017; Pacauskas et al., 2018). Advanced firms have already strategically connected online users in innovation communities which are known as open innovation initiatives (Dong and Wu, 2015). Pacauskas et al. (2018) investigated a hamburger chain store in Finland which conducted a burger design contest by using social media and reported that important benefits from user collaborative activities stem from customers' recognition; for example, the above product design contest formed a community to connect the chain store and customers which informs its offers to customers and raises the consumers' awareness of different options and attributes. Dong and Wu (2015) examined the impact of online user innovation communities formed by using the large-scale panel data from Dell and Starbucks. They found evidence such that online user innovation communities could enhance the capability of public relations implementations which raises the firm value. Moreover, Oginka and Dong (2017) suggested from analysis of Starbucks' data that user interactions and other users' feedbacks may stimulate focal users' contributions to online communities.

As the above literature emphasized, the role of social media is to facilitate collaborating customers to actively participate in firm-sponsored innovation activities by posting and commenting on new ideas for improving and developing products and services; in other words, online user innovation communities can collect ideas and comments from users, which can support to select ideas and to evaluate prototypes based on users' votes (Dong and Wu, 2015; Oginka and Dong, 2017; Pacauskas et al., 2018).

### **1.3 Lead user of consumer collaborative innovation**

Not all consumers are innovators; however, some consumers create or improve products by themselves (user innovation) or with firms (consumer collaborative innovation). von Hippel (1986) pointed out that lead users are in not only user innovation (von Hippel, 1986; 1988) but also consumer collaborative innovation.

Lead users are defined by advanced users who take a lead among the majority of users in future market trends and in solving their needs (von Hippel, 1988). They also have specific experiences in the real world and are on the leading edge of the trend. They are engaged in solving needs and generating insights and useful solutions (von Hippel, 1988).

Franke and Shah (2003) analyzed and summarized such lead users' characteristics as follows: (1) ahead of the trend which includes "I usually find out about new products and solutions earlier than others," "I have benefited significantly by the early adoption and use of new products," "I have tested prototype versions of new products for manufacturers," "In my sport, I am regarded as being on the cutting edge," and "I improved and developed new techniques in the community"; and (2) great benefits from innovation which include "I have new needs which are not satisfied by existing products," and "I am dissatisfied with the existing equipment." Contrary to their assertion, these characteristics pointed out seem more likely to conforming to non-innovators than to innovators. However, the above questions are largely related to the characteristics of lead users and their motivations, which are main interests of this paper as well.

In addition, von Hippel (2005) demonstrates how innovation originated from lead users spreads in innovation communities. They tend to combine their related activities and based on these collaborate to develop, test and sell products through innovation communities.

#### **1.4 Motivation of consumer collaborative innovation**

Consumer innovators and collaborative innovators are thought to be motivated through their vision, creativity, and curiosity to fulfill their perceived needs. Motivation is a psychological factor that affects human decision-making and behavior. There are two kinds of motivations such as intrinsic and extrinsic motivations (Deci and Ryan, 2000; Ryan and Deci, 2000). The former is internal factors and relates to human autonomy such as interest, enjoyment, inherent, and satisfaction (Deci and Ryan, 2000). Ryan and Deci (2000) mentioned the intrinsic motivation is defined as "the doing of an activity for its inherent satisfactions rather than for some separable consequence." When a person intrinsically is motivated, he/she is moved to act for the fun or challenge entailed rather than by external factor such as prods, pressures, or

rewards. This natural motivational tendency is a critical element in cognitive, social, and physical development, because it is through acting on one's inherent interests that one grows in knowledge and skills. As a result, intrinsic motivation affects high-quality learning and creativity (Ryan and Deci, 2000).

On the contrary, extrinsic motivations are factors of creative activities in order to obtain outcomes (e.g., rewards and fame) from external resources (Ryan and Deci, 2000). The extrinsic motivation is not only related to financial rewards but also to human autonomy or self-determinedness. It is also regulations through identification and integration (Deci and Ryan, 2000). Identification affects the recognition that the action is personally important, because it is worthy to achieve the goal. Integration brings out assimilation such that his/her behavior is considered to be consistent with the values and needs of others. Deci and Ryan (2000) indicated such actions characterized by integrated motivation share many qualities with intrinsic motivation, although they are still considered extrinsic motivation because they are done to attain separable outcomes rather than for their inherent enjoyment. This paper discusses intrinsic as well as extrinsic motivations.

The factors related to motivations in consumer innovation or innovation network communities in previous literature are summarized in Table 1. These are motivation factors related to consumer innovation, which are also used for consumer collaborative innovation in this paper.

[Table 1. is positioned about here]

### **1.5 Objectives and Hypotheses**

This paper discusses how to promote consumer collaborative innovation in Japan and the following three are main targets:

1. The relationship between consumer collaborative innovation and network communities by using social media
2. Presence of lead users and their roles in the network communities
3. Motivation of collaborative innovators

The meaning of social media, especially network communities were already examined, as many previous papers emphasized for product innovation (Dodgson et al., 2006; Idota, et al., 2015a, 2015b, 2016) and for consumer collaborative innovation (Oginka

and Dong, 2017; Pacauskas et al., 2018). Consumers also attempt to reach firms which want to develop products through the network communities. Therefore, the following is postulated.

**Hypothesis 1.** *Belonging to network communities is a basis for consumer collaborative innovation*

Lead users also play a central role as innovators in consumer collaborative innovation. The ideas and the evaluations of lead users in the process of consumer collaborative innovation are likely to meet other users' needs. Their information affects other members of the community, and then other members use it for creating their ideas and evaluations. Thus, the following is proposed:

**Hypothesis 2.** *There are lead users of consumer collaborative innovation in network communities.*

Lead users and other collaborative innovators have intrinsic and extrinsic motivations. In previous literature, main motivations are found to be intrinsic factors such as enjoyment, learning, and forms of reciprocity as well as extrinsic factors such as reputation and status (Lakhani and von Hippel, 2003; Raasch and von Hippel, 2013). However, there was no definite result on whether monetary rewards raise consumer's motivation or not.

Monetary rewards often did not exist or played no major role for motivation in innovation communities (Lakhani and von Hippel, 2003; Raasch and von Hippel, 2013). On the other hand, monetary rewards boosted consumer innovators' motivation (Antikainen and Väättäjä, 2010; Ogawa and Pongtanalert, 2013). Even in authors' previous research, monetary rewards were important triggers for user innovation in Japan (Idota, 2019). In consumer collaborative innovation, consumers are much closer to firms than in consumer innovation, since in the former consumers collaborate with firms to improve and develop products. Thus financial returns are necessary to motivate them for participating spontaneously in consumer collaborative innovation. Then the following hypothesis will be examined.



**Hypothesis 3.** *Monetary rewards as extrinsic motivations are more important for consumer collaborative innovation in Japan than intrinsic and other extrinsic motivations.*

## **2. Methodology**

### **2.1 Questionnaire survey**

The web survey on social media usage and consumer innovation experience was conducted in December 2017 and *Rakuten Research Inc.* was selected for this survey. The questionnaire was sent to 3,000 between the ages of 15 and 80 to respond the survey, and responses were selected according to the population ratio of gender and age in the Japanese census data in 2016. The questions in the questionnaire consisted of usage of social media and network communications, experiences of consumer collaborative innovation, motivations, and user attributes such as gender, age, and occupation.

### **2.2 Method and data**

This study employs probit regression, which enables to define the relationship types between consumer collaborative innovation, social media usage, and network community. 14 types of consumer innovation and consumer collaborative innovations are identified. This paper focuses on consumer collaborative innovation such as consumers and firms collaborate with each other for producing new products. In so doing, this paper also focuses on the following two roles of consumers' participations; advising and evaluation. The rationale behind this assumption lies in author's previous study (Idota et al., 2014), which analyzed the relationship between social media usage and product innovation in Japanese leading firms. The result highlighted the reasons of successful social media use in the process of product innovation as follows: (i) firms obtain ideas for new products and services by communicating with opinion leaders (lead users); (ii) firms appoint personnel in charge of product development who can knead concepts of products based on ideas obtained; (iii) firms make out trial plans until a prototype is made, (iv) firms present pricing, advertising methods, and packages to consumers for obtaining their comments and opinions; and (v) comments and their opinions are integrate and final plans are decided. In this flow of product innovation, the most important roles of consumers in consumer

collaboration innovation are found to be two factors: (i) providing ideas and (ii) evaluating prototypes. Therefore, this paper focuses on above two among others. Moreover, another factor found in the paper was whether innovation firms target is improving existing products or developing new ones. This difference affects firms greatly, since the latter requires much greater managerial resources and efforts than the former.

Accordingly, these two factors, namely ways of consumers' contribution and types of product innovation, categorize types of collaborative innovation into the following four:

**Type I:** Advising ideas for improving existing products and services

**Type II:** Evaluating prototypes for improving existing products and services

**Type III:** Advising ideas for developing new products and services

**Type IV:** Evaluating prototypes for developing new products and services

In estimation, the above four types are dependent variables, and if consumers had these experiences, it takes 1, otherwise it takes 0.

On the other hand, based on the questions, the following variables related to consumers' attributes are used for the independent variables: (1) social media usage (0 = no; 1 = yes) ; (2) belonging to network communities (0 = no; 1 = yes) ; (3) role in the network communities such as "Starter," "Administrator," "Active member," "General member," and "Actor with other community members outside the internet" (1 = strongly disagree; 2 = disagree; 3 = undecided; 4 = agree; 5 = strongly agree); (4) lead user such as "If you know a lead user, is the person with whom you have relationships only on the Internet?," "If you know a lead user, is the person (friends, colleagues, etc.) with whom I have relationships inside or outside the Internet?," and "I am a lead user" (0 = no; 1 = yes); (5) motivation of collaborative innovation such as intrinsic and extrinsic motivation (1 = strongly disagree; 2 = disagree; 3 = undecided; 4 = agree; 5 = strongly agree); and (6) Monetary rewards such as "I currently receive monetary rewards," "I received monetary rewards in the past," and "I want to receive monetary rewards in the future" (0 = no; 1 = yes).

In order to eliminate multicollinearity, if the correlation coefficient between independent variables is 0.6 or more, either of them is removed from the variables.

The control variables are selected from questions which are highly correlated with dependent variables. As a result, control variables include the followings: (1)

gender (0 = female; 1 = male); (2) age such as “Less than 40 years old” (0 = 40 years old and more; 1 = less than 40 years old); and (3) occupation such as “University student,” “Employee,” and “Top manager” (0 = no; 1 = yes).

### **2.3 Summary statistics**

Tables 2-8 show the numbers of responses with respect to the independent, dependent, and control variables.

[Table 2-8. are positioned about here]

## **3. Results of estimation**

### **3.1 Demonstration of hypotheses: Hypothesis 1**

This study employs probit analysis, which enables the clarification of the relationships between two types of consumer collaborative innovations and network communities by using social media. First of all, dependent variables are four types of consumer collaborative innovations, while independent variables are social media use and control variables. Table 9 shows the results of estimation. In all types of consumer collaborative innovations, social media use was positively significant ( $p < 0.01$ ).

[Table 9. is positioned about here]

Next, we examine the influence of network communities on consumer collaborative innovation. Dependent variables are the same as previous estimation, while independent variables are belonging network community and control variables. Table 10 shows belonging to the network community was positively significant of both consumer innovations of improving existing products ( $p < 0.01$ ) and developing new products ( $p < 0.01$ ). Thus, Hypothesis 1 was supported.

[Table 10. is positioned about here]

### **3.2 Hypothesis 2: lead user and collaborative innovation**

Here, what types of lead users affect consumer collaborative innovation is examined.

Lead users are “core members of the network community for improving or developing of products and services.” In this case, dependent variables are the same as previous estimation, while independent variables are constructed by the following three types of lead users: (1) person on the Internet such as “If you know lead users, is the persons with whom you have relationships only on the Internet?”; (2) person outside the Internet such as “If you know lead users, are the person (friends, colleagues, etc.) with whom I have relationships inside and outside the Internet?”; and (3) myself such as “I am a lead user.” Again, the same control variables are included.

Regarding the results of estimation, persons in the Internet was positively significant to Type III ( $p < 0.05$ ). Persons outside the Internet were significant for type II ( $p < 0.01$ ), type III ( $p < 0.01$ ) and type VI ( $p < 0.01$ ). Myself such as “I am a lead user” was positively significant to type I ( $p < 0.05$ ), type III ( $p < 0.1$ ) and type VI ( $p < 0.1$ ) (see Table 11). Since it was confirmed that a lead user was useful for all types of consumer collaborative innovations, Hypothesis 2 was demonstrated.

[Table 11. is positioned about here]

Next, independent variables include the roles of lead users in network communities such as “Starter,” “Administrator,” “Active member,” “General member,” and “Actor with other community members outside the Internet” (see Table 12). “Active member” was positively significant to all consumer collaborative innovation (Type I, type II and type III:  $p < 0.01$ ; type VI:  $p < 0.05$ ). “Administrator” was positively significant to developing new products and services (Type III:  $p < 0.01$ ; type VI:  $p < 0.05$ ), however it was not significant for improving existing products and services (Type I and II). On the contrary, “General member” was positively significant to improving existing products and services (Type I:  $p < 0.1$ ; type II:  $p < 0.05$ ), however, it was not significant for developing new products and services (Type III and VI).

[Table 12. is positioned about here]

### **3.3 Hypothesis 3: motivations for collaborative innovation**

This section focuses on motivations to participate in consumer collaborative innovation. In other words, what the kind of motivations induces consumers to consumer collaborative innovation is analyzed. Again four types of consumer collaborative innovations are taken as the dependent variables, while the independent variables are as follows: (1) intrinsic motivations such as “It is important for me to use new products as soon as possible,” “I would like to try my skill by developing and improving new techniques,” and “I want to make better products with help of others”; (2) extrinsic motivations such as “I am regarded as a cutting-edge member in my field (e.g. hobby, work)”; and “My idea may be accepted and I may get monetary rewards”; and (3) control variables.

The results of estimation are shown in Table 13. As a result, the following variables become significant: (1) “It is important for me to use new products as soon as possible” and “I want to make better products with help of others” were only positively significant to Type III ( $p < 0.1$ ;  $p < 0.01$ ), and “I would like to try my skills by developing and improving new techniques” was only positively significant to type I ( $p < 0.05$ ); and (2) “I am regarded as a cutting-edge member in my field (e.g. hobby, work)” was only positively significant to Type III ( $p < 0.05$ ); and “I have received benefits from others' ideas” was found to be only positively significant to Type II ( $p < 0.1$ ) and Type VI ( $p < 0.1$ ).

[Table 13. is positioned about here]

Hypothesis 3 is related to whether monetary rewards were more important for consumer collaborative innovation in Japan than other motivations. The dependent variables are again four types of consumer collaborative innovation, while the independent variables consists of the following: (1) “I currently get monetary rewards”; (2) “I received rewards in the past”; (3) “I want to get rewards in the future”; and (4) control variables.

As the result shown in Table 14, (1) “I currently receive monetary rewards” was positively significant to all types of innovation ( $p < 0.01$ ), and (2) “I received rewards in the past” was positively significant to Type II ( $p < 0.01$ ), Type III ( $p < 0.01$ ) and Type VI ( $p < 0.05$ ). However, (3) “I want to obtain rewards in the future” was only positively significant to Type III ( $p < 0.01$ ). Monetary rewards are thus demonstrated to

affect consumer collaborative innovation. In the previous analysis, monetary rewards were not significant in Type I and III, however, monetary rewards were significant in all types in this analysis (see Tables 13 and 14).

Furthermore, the marginal effects of monetary rewards were found to be greater than those of the other motivations in the earlier analysis. Therefore, Hypothesis 3 was verified.

[Table 14. is positioned about here]

## **4. Discussion**

### **4.1 Strength of ties**

The results of this estimation suggest that social media and network communities based on it are essential for consumer collaborative innovation. In particular, all marginal effects of belonging to network communities for consumer collaborative innovation are greater than that of social media use, implying that simply using social media is not sufficient to consumer collaborative innovation, but belonging to network communities is necessary to connect and participate actively in the network community. The network community has two merits for consumer collaborative innovation; one is to communicate and obtain other members' supports, and another is to connect or access to experts outside the community who own information related to innovation. Krackhardt (1992) showed in the innovation network, the strength of ties with adjacent members is important for innovation. Members communicate closely with each other, share values and behavior patterns, and transfer knowledge, which finally results in innovation. This is an example of "strong ties." Another merit of the network community proposed by Granovetter (1973) is to obtain support from other community members who know experts outside the community, which is an example of "weak ties." Granovetter (1973) pointed out that weak ties have larger information availability, since it becomes easier to acquire new information and resources by connecting with members of other networks. In such cases, to connect to someone who have not been contacted previously may increase opportunities to access new information and innovative ideas, which may trigger innovation. The same point is also applicable to the virtual network community in which users loosely connect each

other with social media. Regarding weak ties, Granovetter (1973) referred the central connection and the marginal connection. Both of connections to community members and to those of outside the community are thus important for consumer collaborative innovation.

## **4.2 Lead users**

Lead users play a central role in the innovation community (von Hippel, 1986; 2005) and consumer collaborative innovation as well. They assist and advice other community members to create ideas and evaluate prototypes. There are three types of lead users in this paper; (i) those on the Internet, (ii) those outside the Internet, and (iii) respondents (myself). (i) includes persons connecting by social media, and (ii) indicates persons connecting by traditional face-to-face. Lead users who are persons only connected on the Internet are significant only for Type III. In addition, lead users who are persons inside and outside the Internet are significant in Type II, III, and IV (Table 11). Since persons outside the Internet are acquaintance, friends, colleagues, and so on, they can communicate in the more intimate way such as face-to-face basis which create more ideas for innovation. Lead users who are myself are significant for Types I, III, and IV.

Although ideas for improvement of existing products (Type I) may be conceived by users themselves, it is also necessary to exchange information with other key persons in order to become creating ideas and evaluating porotypes for new products (Type III and IV). Especially ideas for the creation of new products (Type III), it is essential to exchange information not only with friends and acquaintances, but also with acquaintances on the Internet. On the other hands, in Type II, since consumers evaluate prototypes of improved existing products which they used, they can evaluate the products with reference to opinions of friends and acquaintances as experts.

The above discussion can relate to strength of ties which discussed in 4.1. To connect with persons outside the Internet, which has the greatest marginal effect of all types except Type I, leads to the strong ties of Krackhardt (1992). In contrast, in Type III, only lead users in the Internet are significant, which leads to Granovetter's weak ties (1973) for create new ideas for existing products and services.

Active members are significant for all types of innovation. Other general

members are significant for improving existing products and services for both of Type I and II, whereas administrators are significant for developing new products and services for both of Type III and IV, implying that useful information for innovation is provided not only by lead users but also by other members of network communities. In particular, it follows that the role of general members is larger in improving existing products and services; however, the role of administrator is larger in developing new products and services.

### **4.3 Motivations**

The effects of motivations are different from types of user collaborative innovation. The significant motivation of Type I is “I would like to try my skill by developing and improving new techniques.” The significant motivations of Type III are “it is important for me to use new products as soon as possible,” “I want to make better products with the help of others” and “I am regarded as a cutting-edge member in my field (e.g. hobby, work).” However, the significant motivation of Type II and VI is “my idea may be accepted and I may get monetary rewards,” indicating the followings: (1) advice new ideas of improving and developing products and services are conducted by intrinsic motivations. Moreover, advice new ideas of developing products and services is also conducted by extrinsic motivations such as fame/exposure; and (2) both of evaluations of prototypes improving and developing products and services are expected monetary returns. In addition, experiences rewarded in the past, or obtained rewards are significant even now for both evaluation of prototypes of not only improving but also developing products and services. On the other hand, the importance of extrinsic motivations as rewards for advice new ideas both of both improving and developing products (Type I and III) are not determined. However, experiences of rewards are significant for Types I, II, III, and IV (see Table 14). Received rewards in the past, current, and even in the future are significant for Type III. It can be seen that monetary rewards influence greatly on motivation.

## **5. Conclusion**

This paper clarifies the reasons why consumers commit to collaborative innovation with firms in Japan through the analysis based on the questionnaire survey. The network communities based on social media are focused on. Consumer collaborate



innovators are still minor in Japan (see Table 2). This paper indicates network communities are essential for consumer collaborative innovation. Being able to connect with lead users and other members assists in creating new ideas and evaluating prototypes in network communities. Japanese firms should connect not only to active members but also general members in case of improving existing products and services as well as administrators in case of developing new products.

Regarding motivations, both of intrinsic and extrinsic motivations for fame become significant to creating ideas for improving and developing products and services. However, it turns out that financial motivation is more important in creating ideas. Since monetary rewards are required for all types of collaborative innovations, Japanese firms should reward consumer collaborate innovators for their contribution.

However, this study has some limitations. First, because of the web survey, this data may have biases since it does not cover people who do not use the Internet. Second, our data is restricted to Japan. Similar research in other countries will be required in the future to identify success factors of consumer innovation.

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## **References**

- Antikainen, M. J. and Vääätäjä, H. k. (2010) "Rewarding in open innovation communities – how to motivate members," *International Journal of Entrepreneurship and Innovation Management*, 11 (4), 440-456.
- Brem, A. and Bilgram, V. (2015) The search for innovative partners in co-creation: Identifying lead users in social media through netnography and crowdsourcing, *Journal of Engineering & Technology Management*, 37, 40-51.

- Chesbrough, H. W. (2003) *Open innovation: The new imperative for creating and profiting from technology*, Harvard Business School Press, Boston, Mass.
- Chesbrough, H. W. (2006a) Open innovation: A new paradigm for understanding industrial innovation, In *Open innovation researching a new paradigm*, (Eds. Chesbrough, H. W., Vanhaverbeke, W. and West, J.), *Oxford University Press*, Oxford, UK, pp. 1-12.
- Chesbrough, H. W. (2006b) *Open business model: How to thrive in the new innovation landscape*, Harvard Business School Press, Boston, Mass.
- Cohen, W. M., Nelson, R. R. and Walsh, J. P. (2002) Links and Impacts: The Influence of Public Research on Industrial R&D, *Management Science*, 48 (1) 1-23.
- Dodgson, M., Gann, D., and Salter, A. (2006) The role of technology in the shift towards open innovation: the case of Procter & Gamble, *R&D Management*, 36 (3) 333-346.
- Dong, J. Q., and Wu, W. (2015) Business value of social media technologies: Evidence from online user innovation communities, *The Journal of Strategic Information Systems*, 24 (2) 113–127.
- Franke, N. and Shah, S. (2003) How communities support innovative activities: an exploration of assistance and sharing among end-users, *Research Policy*, 32 (1) 157–178.
- Granovetter, M. (1973) The Strength of Weak Ties, *American Journal of Sociology*, 78 1360-80.
- Hyysalo, S. (2009) User innovation and everyday practices: micro-innovation in sports industry development, *R&D Management* 39 (3) 247-258.
- Idota, H. (2019) Empirical Study on Consumer Innovation by Using Social Media in Japan, *Proceedings of UKAIS2019*, Oxford, UK, 1-19.
- Idota, H., Bunno, T. and Tsuji, M. (2014) Empirical Study on How Social Media Promotes Product Innovation, *Proceedings of the 20th ITS Biennial Conference in RIO DE JANEIRO*, 1-18.
- Idota, H., Bunno, T. and Tsuji, M. (2015a) Empirical Analysis of the Relationship Between Social Media Use and Product Innovation: Focusing on SNS Use and Social Capital, In *The Smart Revolution towards the Sustainable Digital Society*. (Eds. Mitomo, H., Fuke, H. and Bohlin, E.) Edward Elgar, Cheltenham, UK, pp.79-99.
- Idota, H., Bunno, T. and Tsuji, M. (2015b) How Social Media enhances Product Innovation in Japanese Firms, *Proceedings of the Second International Multidisciplinary Networks Conference*, Matsuyama, Japan, Springer, Heidelberg, Berlin, 236-248.
- Idota, H., Bunno, T. and Tsuji, M. (2016).How Japanese Firms Conduct Product Innovation by the Use of Social Media, *Proceedings of the 2016 International Telecommunications Society Biennial Conference*, Taipei, Taiwan, 1-22.
- Jeppesen, L. B., and Frederiksen, L. (2006) Why Do Users Contribute to Firm-Hosted User Community? The Case of Computer-Controlled Music Instruments, *Organization Science*, 17(1), 45-63.

- Krackhardt, D. (1992) The Strength of Strong Ties: The Importance of Philos in Organization in Organizations, in *Networks and Organizations: Structure, Form, and Action*, (Eds. Nohria, N. and Eccles, R. G.), *Harvard Business School Press*, Boston, Mass, pp.216-239.
- Lakhani, K. C. and von Hippel, E. (2003) How open source software works: “free” user-to-user assistance, *Research Policy*, 32 (9) 923-43.
- Lee, G., and Xia, W. (2006) Organizational size and IT innovation adoption: A meta-analysis, *Information & Management*, 43 979-985.
- Lerner, J. and Tirole, J. (2002) Some Simple Economics of Open Source, *The Journal of Industrial Economics*, 50(2), 197-234.
- Lüthje, C. (2004) Characteristics of innovating users in a consumer goods field: an empirical study of sport related product consumers, *Technovation*, 24 (9) 683–695.
- Lüthje, C., Herstatt, C. and von Hippel, E. (2005) User innovators and “local” information: the case of mountain biking, *Research Policy*, 34 (6) 951–965.
- Ogawa, S. and Pongtanalert, K. (2013) Exploring Characteristics and Motives of Consumer Innovators, *Research-Technology Management*, 56(3) 41-48.
- Ogink, T. and Dong, J. Q. (2017) Stimulating innovation by user feedback on social media: The case of an online user innovation community, *Technological Forecasting & Social Change*, In press 1-8.
- Pacauskas, D., Rajala, R., Westerlund, M. and Mäntymäki, M. (2018) Harnessing user innovation for social media marketing: Case study of a crowdsourced hamburger, *International Journal of Information Management*, 43 319–327.
- Raasch, C. and von Hippel, E. (2013) Innovation Process Benefits: The Journey as Reward, *MIT Sloan Management Review*, 55 (1) 33-39.
- Ståhlbröst, A. and Bergvall-Kåreborn, B. (2011) Exploring users motivation in innovation communities, *International Journal of Entrepreneurship and Innovation Management*, 14 (4) 298-314.
- von Hippel, E. (1976) The dominant role of users in the scientific instrument innovation process, *Research Policy*, 5(3) 212-239.
- von Hippel, E. (1986) Lead Users: A Source of Novel Product Concepts, *Management Science*, 32(7) 791-805.
- von Hippel, E. (1988) *The Sources of Innovation*, Oxford University Press: New York.
- von Hippel, E. (2005) *Democratizing Innovation*, The MIT Press Cambridge, Mass.
- von Hippel, E., Ogawa, S. and De Jong, J. P. J. (2011) The Age of the Consumer-Innovator, *MIT Sloan Management Review*, 53 (1) 27-35.

Table 1. Motivation items of consumer innovation or innovation network community

Types of motivations			Papers
Intrinsic motivation	Hedonic	Curiosity	Franke and Shah (2003), Ståhlbröst and Bergvall-Kåreborn (2011), Raasch and von Hippel (2013), and Ogawa and Pongtanalert (2013)
		Enjoyment	Franke and Shah (2003), Ståhlbröst and Bergvall-Kåreborn (2011), Raasch and von Hippel (2013) ,and Ogawa and Pongtanalert (2013)
	Challenging	Learning or developing skills	Ståhlbröst and Bergvall-Kåreborn (2011), Raasch and von Hippel (2013) and, Ogawa and Pongtanalert (2013)
		Testing technical solutions	Franke and Shah (2003), and Ståhlbröst and Bergvall-Kåreborn (2011)
		Being first to test innovation	Franke and Shah (2003), and Ståhlbröst and Bergvall-Kåreborn (2011)
	Social interaction	Reciprocity	Ståhlbröst and Bergvall-Kåreborn (2011), and Ogawa and Pongtanalert (2013)
		Getting acquainted new people	Ståhlbröst and Bergvall-Kåreborn (2011)
		Social belonging	Ståhlbröst and Bergvall-Kåreborn (2011)
		Making a better society	Ståhlbröst and Bergvall-Kåreborn (2011)
Extrinsic motivation	Fame/Exposure	Peer recognition among members	Lerner and Tirole (2002), Jeppesen and Frederiksen (2006), and Ogawa and Pongtanalert (2013)
		Recognizing from firm	Jeppesen and Frederiksen (2006), and Ogawa and Pongtanalert (2013)
		Fame/reputation	Franke and Shah (2003), Raasch and von Hippel (2013), and Ogawa and Pongtanalert (2013)
	Rewards	Monetary rewards	Lakhani and von Hippel (2003), Antikainen and Vääätäjä (2010), Raasch and von Hippel (2013), and Ogawa and Pongtanalert (2013)

Table 2. Independent Valuables: Consumer collaborative innovation

			Yes=1	No=0	Total
Improving products and services	<b>Type I:</b> I have posted ideas for improving products and services (e.g. arrangement, customization, design, illustration) to the network community	N	121	2,879	3,000
		%	4.0	96.0	100.0
	<b>Type II:</b> I have tried prototypes and cooperated in improving products and services	N	199	2,801	3,000
		%	6.6	93.4	100.0
Developing products and services	<b>Type III:</b> I have posted ideas for developing new products and services to the network community	N	100	2,900	3,000
		%	3.3	96.7	100.0
	<b>Type VI:</b> I have tried prototypes and cooperated in developing products and services	N	148	2,852	3,000
		%	4.9	95.1	100.0

Table 3. Dependent variables 1: Social media use and belonging network community

		Yes=1	No=0	Total
Social media use	N	2,120	880	3,000
	%	70.7	29.3	100.0
Belonging to the network community	N	602	1,518	2,120
	%	28.4	71.6	100.0

Note: 2,120 respondents replied SNS use as "Yes"

Table 4. Dependent variables 2: Role of the network community

		Strong agree = 5	Agree= 4	Undecided= 3	Disagree= 2	Strong disagree = 1	Total	
Role of the network community	I started the community	N	39	64	69	82	348	602
		%	6.5	10.6	11.5	13.6	57.8	100.0
	I am an administrator of the community	N	30	60	79	70	363	602
		%	5.0	10.0	13.1	11.6	60.3	100.0
	I am actively talking on the community (e.g. active member)	N	34	101	127	109	231	602
		%	5.6	16.8	21.1	18.1	38.4	100.0
	I am a general participant in the community (general member)	N	119	242	128	43	70	602
		%	19.8	40.2	21.3	7.1	11.6	100.0
	I act with other community members outside the Internet	N	47	137	139	81	198	602
		%	7.8	22.8	23.1	13.5	32.9	100.0

Note: 602 respondents replied who answered belonging network community as "Yes"

Table 5. Dependent variables 3: Motivation

			Strong agree=5	Agree=4	Undecided=3	Disagree=2	Strong disagree=1	Total
Motivation	Intrinsic motivation: Hedonic	(1) It is easy for me to find solutions and ideas of new products earlier than others	N 41 % 9.7	102 24.1	170 40.1	76 17.9	35 8.3	424 100.0
		(2) I am dissatisfied with existing products and have new needs	N 39 % 9.2	134 31.6	156 36.8	72 17.0	23 5.4	424 100.0
	Intrinsic motivation: Challenging	(3) It is important for me to use new products as soon as possible	N 55 % 13.0	118 27.8	143 33.7	68 16.0	40 9.4	424 100.0
		(4) I would like to try my skill by developing and improving new techniques	N 33 % 7.8	71 16.7	188 44.3	82 19.3	50 11.8	424 100.0
	Intrinsic motivation: Social belonging	(5) I want to make better products with the help of others	N 35 % 8.3	119 28.1	165 38.9	67 15.8	38 9.0	424 100.0
		(6) I had previously benefited from ideas that others thought	N 27 % 6.4	81 19.1	153 36.1	91 21.5	72 17.0	424 100.0
	Extrinsic motivation: Fame/exposure	(7) I am regarded as a cutting-edge member in my field (e.g. hobby, work)	N 28 % 6.6	71 16.7	165 38.9	93 21.9	67 15.8	424 100.0
		(8) I would like to be recognized or to be admired by others and firms	N 28 % 6.6	78 18.4	154 36.3	97 22.9	67 15.8	424 100.0
	Extrinsic motivation: Rewards	(9) My idea may be accepted and I may get monetary rewards	N 31 % 7.3	95 22.4	156 36.8	78 18.4	64 15.1	424 100.0
	Other	(10) I created without any particular reason (i.e., without expecting any benefits)	N 41 % 9.7	128 30.2	165 38.9	50 11.8	40 9.4	424 100.0

Note: 424 respondents replied "Yes" to one or more of 14 types of consumer innovation

(1), (2), (3), (4) and (7) are quoted from Franke and Shah (2003) and (5), (6), (8), (9) and (10) are quoted from Ogawa and Pongtanalert (2013).

Table 6. Dependent variables 4: Monetary rewards

		Yes = 1	No = 0	Total
Monetary rewards	I currently get monetary rewards	N	32	424
		%	7.5	100.0
	I received monetary rewards in the past	N	53	424
		%	12.5	100.0
	I do not get monetary rewards but I want to get them in the future	N	135	424
		%	31.8	100.0
	Does not correspond to above questions	N	204	424
		%	48.1	100.0

Note: 424 people who replied "Yes" in one or more of 14 types of consumer innovation and responded "Yes" to any question of monetary rewards

Table 7. Dependent variables 5: Lead user

		Yes = 1	No = 0	Total
Lead user	Lead user is that person with whom you have relationships only on the Internet	N	120	210
		%	57.1	100.0
	Lead user is that person (friend, colleague, etc.) with whom I have relationships on the Internet and outside the Internet	N	89	210
		%	42.4	100.0
	I am a lead user	N	70	210
		%	33.3	100.0

Note: 210 respondents replied belonging network community as "Yes," and replied "Yes" in one or more of 14 types of consumer innovation



Table 8. Control variables: Gender, age, and occupation

		Male = 1	Female = 0	Total
Gender	N	1,489	1,511	3,000
	%	49.6	50.4	100.0
		Less than 40 = 1	40 or more = 0	Total
Age	N	1,011	1,989	3,000
	%	33.7	66.3	100
		Yes = 1	No = 0	Total
Occupation	University Student	N	2,890	3,000
		%	96.3	100.0
	Employee	N	1,459	3,000
		%	48.6	100.0
	Top Manager	N	2,852	3,000
		%	95.1	100.0

Table 9. Social media use and consumer collaborative innovation

	Improving products and services				Developing new products and services			
	Type I Ideas		Type II Evaluation		Type III Ideas		Type IV Evaluation	
	Mfx		mfx		mfx		mfx	
SNS Use	0.810*** 0.172	0.038*** 0.006	0.658*** 0.112	0.062*** 0.008	0.988*** 0.239	0.033*** 0.005	0.468*** 0.111	0.038*** 0.008
Gender	0.334*** 0.094	0.020*** 0.006	0.014 0.075	0.0016 0.009	0.187* 0.099	0.008* 0.005	0.071 0.082	0.007 0.008
Less than 40 years old	0.362*** 0.094	0.025*** 0.007	0.188** 0.079	0.022** 0.010	0.397*** 0.101	0.021*** 0.006	0.045 0.088	0.004 0.009
University student	0.283 0.194	0.022 0.019	0.029 0.184	0.0033 0.0217	0.337 0.207	0.021 0.017	0.119 0.203	0.012 0.023
Employee	0.128 0.107	0.008 0.006	0.022 0.083	0.0025 0.010	0.270** 0.119	0.012** 0.005	0.049 0.090	0.005 0.009
Top manager	0.452** 0.185	0.040* 0.023	0.374** 0.157	0.055* 0.029	0.482** 0.212	0.034 0.021	0.227 0.175	0.026 0.023
Constant	-2.908*** 0.184		-2.153*** 0.111		-3.197*** 0.252		-2.116*** 0.110	
Observations	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Pseudo R-squared	0.0953		0.0473		0.102		0.0251	
Log likelihood	-458.7		-697.5		-393.8		-574.8	

Note: low line shows standard errors, mfx is marginal effect, and \*\*\*, \*\*, \* indicate  $p < 0.01$ ,  $p < 0.05$ ,  $p < 0.1$ , respectively.

Table 10. Network community on social media and collaborative innovation

	Improving products and services				Developing new products and services			
	Type I Ideas		Type II Evaluation		Type III Ideas		Type IV Evaluation	
	mfx		mfx		mfx		mfx	
Belonging to network community	1.024*** 0.103	0.115*** 0.014	0.854*** 0.083	0.150*** 0.017	1.247*** 0.121	0.114*** 0.014	0.751*** 0.092	0.103*** 0.015
Gender	0.401*** 0.107	0.029*** 0.008	0.046 0.085	0.006 0.011	0.266** 0.115	0.013** 0.006	0.104 0.094	0.011 0.010
Less than 40 years old	0.247** 0.105	0.018** 0.008	0.110 0.087	0.015 0.012	0.314*** 0.116	0.016** 0.006	-0.034 0.097	-0.004 0.010
University student	0.085 0.211	0.007 0.017	-0.111 0.195	-0.014 0.022	0.203 0.224	0.012 0.015	-0.027 0.216	-0.003 0.022
Employee	-0.013 0.120	-0.001 0.009	-0.027 0.095	-0.004 0.013	0.165 0.137	0.008 0.006	-0.018 0.104	-0.002 0.011
Top manager	0.375* 0.205	0.037 0.026	0.353** 0.176	0.059* 0.036	0.423* 0.239	0.03 0.024	0.251 0.192	0.031 0.028
Constant	-2.467*** 0.130		-1.791*** 0.091		-2.803*** 0.162		-1.895*** 0.099	
Observations	2,120	2,120	2,120	2,120	2,120	2,120	2,120	2,120
Pseudo R-squared	0.164		0.0967		0.212		0.0752	
Log likelihood	-376.2		-562.9		-313		-452.1	

Note: low line shows standard errors, mfx is marginal effect, and \*\*\*, \*\*, \* indicate  $p < 0.01$ ,  $p < 0.05$ ,  $p < 0.1$ , respectively.

Table 11. Lead user and consumer collaborative innovation

	Improving products and services				Developing new products and services			
	Type I Ideas		Type II Evaluation		Type III Ideas		Type IV Evaluation	
	mfx		mfx		mfx		mfx	
Person on the Internet	0.222 0.202	0.086 0.078	0.159 0.198	0.063 0.078	0.470** 0.206	0.177** 0.075	0.016 0.201	0.006 0.076
Person on the Internet and outside the Internet	0.254 0.192	0.099 0.075	0.523*** 0.191	0.202*** 0.072	0.535*** 0.194	0.205*** 0.073	0.443** 0.190	0.169** 0.072
I am a lead user	0.528** 0.219	0.207** 0.085	0.332 0.224	0.128 0.085	0.366* 0.221	0.142* 0.086	0.391* 0.220	0.151* 0.085
Gender	0.058 0.197	0.023 0.076	-0.344* 0.196	-0.134* 0.075	0.170 0.199	0.065 0.076	-0.107 0.193	-0.041 0.074
Less than 40 years old	0.013 0.196	0.005 0.076	-0.049 0.193	-0.019 0.076	0.111 0.198	0.042 0.075	-0.108 0.193	-0.041 0.074
University student	0.720* 0.395	0.280* 0.143	-0.297 0.392	-0.118 0.155	-0.167 0.403	-0.063 0.147	0.089 0.395	0.034 0.154
Employee	0.292 0.247	0.112 0.093	0.024 0.240	0.009 0.094	0.181 0.249	0.069 0.094	0.010 0.239	0.004 0.091
Top manager	0.683 0.428	0.267* 0.157	0.063 0.424	0.025 0.165	0.025 0.436	0.01 0.168	-0.110 0.420	-0.041 0.155
Constant	-0.965*** 0.285		-0.012 0.270		-1.172*** 0.292		-0.509* 0.271	
Observations	210	210	210	210	210	210	210	210
Pseudo R-squared	0.0854		0.0671		0.101		0.0487	
Log likelihood	-130.6		-134.3		-127		-133.2	

Note: low line shows standard errors, mfx is marginal effect, and \*\*\*, \*\*, \* indicate  $p < 0.01$ ,  $p < 0.05$ ,  $p < 0.1$ , respectively.

Table 12. Rule of Network community and collaborative innovation

	Improving products and services				Developing new products and services			
	Type I Ideas		Type II Evaluation		Type III Ideas		Type IV Evaluation	
	mfx		mfx		mfx		mfx	
Starter the community	-0.012	-0.002	0.047	0.012	-0.028	-0.005	0.078	0.014
	0.106	0.019	0.101	0.024	0.108	0.018	0.105	0.018
Administrator of the community	0.146	0.027	0.166	0.042	0.319***	0.054***	0.262**	0.046**
	0.112	0.020	0.107	0.027	0.114	0.020	0.111	0.020
Active member	0.316***	0.057***	0.199***	0.050***	0.235***	0.040***	0.146**	0.026**
	0.070	0.012	0.064	0.016	0.074	0.012	0.074	0.013
General member	0.131*	0.024*	0.133**	0.033**	-0.013	-0.002	0.033	0.006
	0.070	0.013	0.060	0.015	0.071	0.012	0.068	0.012
Actor with other community members outside the internet	-0.012	-0.002	-0.039	-0.01	0.024	0.004	0.006	0.001
	0.065	0.012	0.058	0.015	0.070	0.012	0.068	0.012
Gender	0.082	0.015	-0.127	-0.032	0.101	0.017	-0.108	-0.02
	0.148	0.027	0.132	0.033	0.152	0.026	0.150	0.030
Less than 40 years old	0.094	0.017	0.078	0.02	0.092	0.015	-0.042	-0.007
	0.150	0.027	0.132	0.033	0.153	0.026	0.151	0.030
University student	0.492*	0.113	-0.122	-0.029	-0.012	-0.002	0.038	0.007
	0.284	0.079	0.272	0.062	0.311	0.052	0.299	0.055
Employee	0.455**	0.079**	0.246	0.06	0.351*	0.057*	0.188	0.032
	0.189	0.031	0.154	0.037	0.188	0.029	0.175	0.030
Top manager	0.635**	0.157	0.235	0.065	0.083	0.015	0.026	0.0047
	0.318	0.099	0.295	0.089	0.342	0.063	0.333	0.060
Constant	-3.107***		-2.318***		-2.738***		-2.429***	
	0.339		0.273		0.325		0.302	
Observations	602	602	602	602	602	602	602	602
Pseudo R-Squared	0.178		0.121		0.208		0.170	
Log likelihood	-205.8		-261.8		-192.7		-197.4	

Note: low line shows standard errors, mfx is marginal effect, and \*\*\*, \*\*, \* indicate  $p < 0.01$ ,  $p < 0.05$ ,  $p < 0.1$ , respectively.

Table 13. Motivation and consumer collaborative innovation

		Improving products and services				Developing new products and services			
		Type I Ideas		Type II Evaluation		Type III Ideas		Type IV Evaluation	
		mfx		mfx		mfx		mfx	
Intrinsic motivation	It is important to use new products as soon as possible	-0.015	-0.005	0.078	0.031	0.149*	0.041*	0.100	0.037
		0.079	0.026	0.071	0.028	0.085	0.023	0.073	0.027
	I try my skill by developing and improving new techniques	0.192**	0.063**	-0.004	-0.002	-0.036	-0.01	0.034	0.013
		0.094	0.031	0.089	0.036	0.102	0.028	0.091	0.034
Extrinsic motivation	I want to make better products with the help of others	0.076	0.025	0.097	0.039	0.244***	0.067***	0.101	0.037
		0.082	0.027	0.073	0.029	0.09	0.024	0.076	0.028
	I am regarded as a cutting-edge member in my field	0.123	0.04	-0.007	-0.003	0.218**	0.059**	-0.110	-0.04
		0.094	0.031	0.089	0.035	0.100	0.027	0.090	0.033
My idea may be accepted and I may get monetary rewards		-0.003	-0.001	0.117*	0.047*	0.093	0.026	0.132*	0.049*
		0.073	0.024	0.065	0.026	0.079	0.02	0.068	0.025
Gender		0.284**	0.092**	-0.303**	-0.120**	0.009	0.0024	-0.090	-0.033
		0.145	0.046	0.132	0.052	0.155	0.042	0.134	0.049
Age	Less than 40 years old	0.293**	0.096**	0.000	8.21e-05	0.304*	0.083*	-0.314**	-0.115**
		0.146	0.048	0.134	0.053	0.157	0.043	0.139	0.050
Occupation	University Student	0.186	0.064	-0.260	-0.101	0.124	0.035	-0.060	-0.022
		[0.304]	0.109	0.289	0.110	0.317	0.094	0.302	0.109
	Employee	0.148	0.048	0.054	0.022	0.275	0.074	0.082	0.03
		0.167	0.054	0.148	0.059	0.185	0.049	0.152	0.056
	Top manager	0.279	0.097	0.258	0.103	0.175	0.051	0.002	0.001
		0.280	0.103	0.261	0.103	0.321	.098	0.269	0.099
Constant		-2.117***		-0.797***		-3.191***		-1.052***	
		0.289		0.241		0.362		0.249	
Observations		424	424	424	424	424	424	424	424
Pseudo R-squared		0.0959		0.0346		0.159		0.0336	
Log likelihood		-229.2		-282.9		-194.8		-265.1	

Note: low line shows standard errors, mfx is marginal effect, and \*\*\*, \*\*, \* indicate  $p < 0.01$ ,  $p < 0.05$ ,  $p < 0.1$ , respectively.

Table 14. Monetary rewards and consumer collaborative innovation

	Improving products and services				Developing new products and services			
	Type I Ideas		Type II Evaluation		Type III Ideas		Type IV Evaluation	
	mfx		mfx		mfx		Mfx	
I currently get rewards	0.953*** 0.252	0.359*** 0.096	0.828*** 0.258	0.310*** 0.083	1.467*** 0.261	0.528*** 0.088	1.127*** 0.256	0.426*** 0.084
I received rewards in the past	0.279 0.209	0.098 0.077	0.720*** 0.204	0.276*** 0.071	0.960*** 0.215	0.333*** 0.081	0.451** 0.202	0.174** 0.080
I want to get rewards in the future	0.200 0.156	0.068 0.054	0.111 0.143	0.044 0.057	0.526*** 0.170	0.160*** 0.054	0.110 0.149	0.041 0.056
Gender	0.355** 0.143	0.115** 0.046	-0.306** 0.132	-0.121** 0.052	0.090 0.154	0.0253 0.043	-0.078 0.135	-0.029 0.050
Less than 40 years old	0.308** 0.143	0.102** 0.047	0.014 0.134	0.006 0.053	0.341** 0.153	0.097** 0.044	-0.316** 0.139	-0.115** 0.050
University student	0.335 0.297	0.119 0.112	-0.152 0.289	-0.06 0.113	0.301 0.313	0.094 0.106	0.036 0.303	0.013 0.113
Employee	0.190 0.161	0.063 0.053	0.045 0.145	0.018 0.058	0.339* 0.176	0.095* 0.049	0.048 0.148	0.018 0.055
Top manager	0.272 0.281	0.096 0.104	0.188 0.263	0.075 0.104	0.123 0.320	0.036 0.098	-0.147 0.270	-0.053 0.094
Constant	-1.270*** 0.160		-0.125 0.134		-1.647*** 0.185		-0.400*** 0.137	
Observations	424	424	424	424	424	424	424	424
Pseudo R-squared	0.0767		0.0449		0.145		0.0485	
Log likelihood	-234.1		-279.9		-198.1		-261	

Note: low line shows standard errors, mfx is marginal effect, and \*\*\*, \*\*, \* indicate  $p < 0.01$ ,  $p < 0.05$ ,  $p < 0.1$ , respectively.