

## **The Impact of user Proposals in the Open Community on Product Iterative Innovation: Based on the Case of Xiaomi's Online Community**

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**Abstract.** Crowdsourcing innovation obtains external knowledge and technology through the Internet, it introduces the wisdom of the public into enterprise innovation, and realizes the co-creation of the value of public knowledge. In order to verify the importance of crowdsourcing innovation to enterprises, this paper takes the Xiaomi's online community as an example, crawls the data of submitted proposal proposed by users about two mobile phones named Xiaomi 9 and Xiaomi 10 in the community. And the word frequency and keyword analysis of the proposal data was executed. The analysis results show that the improvement proposal contents of Xiaomi 9 that concentrated on the system, processor and screen are closely related with the improvements of Xiaomi 10. Similarly, the improvement proposal contents for Xiaomi 10 that concentrated on the system and the processor are also fully reflected in the actual improvements of Xiaomi 11. The research results demonstrate that the crowdsourcing innovation in the Xiaomi community plays a significant role to guide the product innovation for Xiaomi phones, and provides direct supports to the company's product innovation.

**Keyword:** Open innovation; crowdsourcing innovation; Xiaomi community; iterative innovation

### **1. Introduction**

In traditional enterprise innovation, enterprise internal knowledge is the only source of innovation. However, with the intensified market competition, it is difficult for the

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innovation within the enterprise to keep up with the innovation of the entire market. As a result, users began to gradually participate in corporate innovation. Therefore, it has become a company's internal innovation involving employees and allowing users to participate in a free and voluntary manner. This type of innovation is called crowdsourcing innovation. Crowdsourcing innovation enables enterprises and users to achieve a win-win situation, crowdsourcing innovation helps enterprises make up for the lack of internal innovation, and users obtain satisfactory products by participating in product innovation. For example, in Dell's "Creative Storm" community, more than 550 ideas have been implemented; P&G's "Innovation Center" community has increased the company's R&D capabilities by more than 60%. Xiaomi community also belongs to the crowdsourcing innovation community. Xiaomi's product improvements and innovations through the suggestions and ideas of users in the Xiaomi community have brought huge benefits to Xiaomi. In the crowdsourcing community, companies can make rapid improvements to products based on user suggestions and ideas, thereby accelerating product innovation.

In different crowdsourcing innovation communities, the mechanism of innovation is also different. For example, Haier's HOPE platform will send project requirements to registered users, and users will decide whether to participate in the solution of the project based on their own knowledge reserves and actual conditions. After users participate in the project and give corresponding opinions, the provision of technology will make a preliminary assessment of the feasibility and reliability of the opinions [1]; For example, with the help of the InnoCentive innovation community, P&G seeks "solver" ideas by publicly publishing the company's internal tasks on the innovation community, and provides corresponding remuneration, which saves P&G a lot of costs. Starbucks established the My Starbucks Idea.com crowdsourcing innovation community to encourage consumers to give Starbucks opinions through this channel, and make timely adjustments based on their opinions, then establish its brand image in the minds of consumers[2]; Midea's Mechuang platform provides it with a wealth of innovative ideas, high-quality suppliers, top scientific research institutions and many incubator resources, making it an entrepreneurial incubation platform for the masses[3]. In the Xiaomi community, users can freely express their views and opinions on any product or service of Xiaomi, and propose improvements and innovations. In the innovation mechanism of this model of Xiaomi community, companies are mining innovation based on user comments. This article is based on this innovation mechanism to study the impact of user comments on product innovation [4].

## **2. Theoretical basis**

### **2.1. Crowdsourcing innovation**

Many scholars have defined crowdsourcing innovation from different perspectives.

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Jeppesen and others believe that crowdsourcing innovation means that companies with innovative needs make their needs to public, and choose the best one from the public's ideas to complete their tasks [5]. Winsor defines crowdsourcing innovation as a process of gathering knowledge from the public to the enterprise [6]. Afuah believes that crowdsourcing innovation is a new way to solve corporate problems through public knowledge and improve the intimacy between companies and users [7]. Seltzer believes that crowdsourcing innovation is a challenge to a large and diverse group, hoping that they can find new solutions that are more powerful than those within the organization [8]. Oliveira et al. regard crowdsourcing innovation as a special way to start the innovation process, using large personal networks to acquire and explore external knowledge, technology and capabilities, and bring "group wisdom" into the company for innovation. Crowdsourced innovation is based on the research of scholars. Crowdsourced innovation is a kind of exploration for companies to gather public knowledge through innovation platforms to solve corporate problems. It has a similar definition to open innovation.

Crowdsourcing innovation allows companies to break the previous management model, pay attention to the ideas of the public, break the previous leading position of professional long-term monopoly product design in all walks of life, meet the requirements of users to the greatest extent, and facilitate the provision of personalized products and service. At the same time, the company's budget is reduced, excellent solutions can be collected from all directions, reduced the cost of paying for expensive innovative solutions, and a loyal consumer group has been established, making it the best promoter of the company's products. The development of crowdsourcing innovation has broad prospects, but its research is still in its infancy, and related research is still fragmented. Relevant scholars have carried out research on the related issues of crowdsourcing innovation performance from the following aspects: (1) User motivation for participation. Some scholars have conducted research on existing crowdsourcing innovation platforms, and put forward external motivations (such as rewards, ability enhancement, etc.) [9] and internal motivations (such as personal interests, etc.) [10] for users to participate in crowdsourcing innovation. Some scholars have proposed that the public provide their intellectual products to the platform, and the intellectual property rights belong to the author. If the user's rights are violated in the process, it will reduce the user's willingness to participate [11]. Execution cost is time, energy, material and financial resources that an individual spends to engage in a certain behavior, and the user's actions will be affected by the execution cost. (2) Project characteristics. Some research results show that the performance of crowdsourcing innovation will be affected by the number of contractors and task uncertainty. Projects with high bonuses or long task cycles are more likely to receive the attention and participation of users, and it is easier for enterprises to obtain better

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innovations [12]. (3) Crowdsourcing project platform. The quality of the crowdsourcing system and information determines the quality of the operation of the crowdsourcing community. The better the quality of the crowdsourcing community, the better its reputation, and the greater the possibility that the public will choose to enter the platform [13]. (4) Knowledge sharing under the crowdsourcing innovation model. Based on research, some scholars have shown that it is not enough to analyze knowledge sharing under crowdsourcing innovation from the motivation of participation, so they proposed to study knowledge sharing from three dimensions: ability, motivation, and opportunity [14]; Other scholars indicate that the willingness of users to share knowledge and the reward mechanism of the crowdsourcing innovation platform will have a certain impact on the performance of the crowdsourcing innovation platform [15].

## **2.2. Crowdsourcing innovation communities**

In 2010, Xiaomi adopted a "crowdsourcing" model when developing the MIUI operating system, collecting opinions through interaction with fans on the Xiaomi forum, and quickly updating the version every week to make product improvements. The research and development of Xiaomi mobile phones has also continued this model. Before the development of new functions of the mobile phone, some ideas will be revealed to users through the forum, allowing users to vote on what kind of product they need, Xiaomi's lockless flashing function and the setting of Xiaomi's mobile phone input method are improved in real time under the user's suggestion. This model allows more problems to be exposed as much as possible in the early stage, reduces the risk of product release, and helps companies truly understand the needs of users. At the same time, these "enthusiasts" have also become the most loyal customers of Xiaomi mobile phones, and they have become the main force to help the word-of-mouth publicity of Xiaomi mobile phones, which is almost the lowest cost promotion method. Xiaomi's crowdsourcing innovation platform has achieved multiple corporate long-term goals such as product innovation, close contact with users, and product promotion. Companies such as Haier, Starbucks, Midea, and Procter & Gamble also use such methods to establish or rely on a virtual platform as a channel for enterprises to contact and communicate with consumers, and to understand users' ideas or suggestions on enterprise product development tasks. In contrast, Xiaomi's MIUI community pays more attention to the sense of communication with users, not only collecting users' innovative ideas, but more important is to improve products based on needs, better serving the public, and creating a universally recognized brand.

Chesbrough believes that the crowdsourcing innovation community uses the purposeful inflow and outflow of knowledge, accelerates internal innovation through the integration of internal and external innovation, and effectively expands the product market [16]. Enterprises use money to attract the participation of many users through the

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establishment of corresponding crowdsourcing platforms. While solving enterprise problems, they also bring certain incentives to the participants themselves, prompting them to provide enterprises with more creativity. Petra et al. proposed that under the conditions of the development of Web2.0, companies can collect user feedback through various platforms to solve the current thorny problems of the company. There is no end in product development. Products can always communicate with users in real time through the platform and continue to improve [17]. Secondly, through the crowdsourcing platform, companies can also let users use products that have not yet been developed, and make the next round of product demand improvement based on user feedback, and gradually make the product more complete [18]. Keupp et al. have proved through research that companies that use innovation platforms have higher profit margins for their products developed, and their improvement effects on products are also very significant [19]. The reason is that through the communication of the innovative platform, a product that is more suitable for users is designed. Leiponnen et al. found through analysis of survey data that companies maintaining an open information strategy and "open innovation" thinking also have a positive impact on their innovation activities [20].

### **3. Data acquisition and analysis**

#### **3.1. Data acquisition**

The data in this article is based on the data from the Xiaomi community's proposals for Xiaomi 9, Xiaomi 10 and Xiaomi 11 mobile phones, and captures the comments between the release time of Xiaomi 9 and the release time of Xiaomi 10 and the release time of Xiaomi 10 to Xiaomi 11. The reasons for choosing Xiaomi community as the research object of this article are as follows: (1) Xiaomi community is a typical crowdsourcing innovation platform, and user comment data is targeted for research; (2) Xiaomi mobile phone update iteration relatively fast, you can find many iterative products in the Xiaomi community. For each product user, you can find the corresponding circle in the Xiaomi community to discuss; (3) The data of the proposal can better reflect the innovation of Xiaomi's suggestions and help from users, and the data can show whether it is optimized, developed and processed.; (4) There are more active people in the Xiaomi community, and user's participation and loyalty are relatively high. Most of the user comment data are quality comments.

The data in this article comes from the proposal data of Xiaomi 9, Xiaomi 10 and Xiaomi 11 in the Xiaomi community. Since the Python language has many advantages over other programming languages in terms of data crawling, the Python language can use numerous extension libraries to achieve data acquisition. In the end, a total of 484 pieces of proposal data concerning Xiaomi 9 mobile phones and 6,200 pieces of proposal data

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concerning Xiaomi 10 mobile phones were captured. Then, according to the factors that the public users are interested in mobile phones, a keyword table is formed to filter data, and 188 pieces of data about Xiaomi 9 mobile phone proposal data and 3537 pieces of data about Xiaomi 10 mobile phone proposal data are filtered out. Screening words are needed in the process of screening. This article collects common descriptive words about the appearance, functions, performance parameters and other aspects of mobile phone products, and determines the screening words based on this. Some of the screening words as listed in Table 1.

**Table 1:** Screening words

price	Crash	processor	take	color	Negative one screen	Power consumption
Price	WIFI	Running speed	Take a video	screen	Screen size	Electricity
system	make a telephone call	storage of phone	camera	Refresh rate	workmanship	Heat dissipation
Carton	data	storage	Wide angle	Black screen	Material	microphone
After-sales service	MIUI	Running speed	Crash	Lock screen	Material	sound recording

### **3.2. Data processing**

#### **3.2.1. Participle**

Word segmentation is the process of re-segmenting and combining sentences or paragraphs, like semantically coherent sentences, into words according to corresponding rules. In Chinese, sentences and paragraphs can generally only be divided by punctuation marks and separators. The main task of text segmentation is to find a delimiter that can distinguish words with special rules. Due to its strong complexity, Chinese is much more complicated than English text segmentation, and the effect is not as good as that of English morphology. This paper selects the JIEBA word segmentation algorithm of python language to do simple word segmentation processing on the original comment data.

#### **3.2.2. Filter stop words**

Stop words refer to words that appear frequently in the acquired text data, but cannot actually contribute to the thoughts that the text mainly wants to express. If we do not eliminate these meaningless words before the clustering algorithm, then this will have a

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great negative effect on the results of the subsequent algorithm. Based on the Chinese vocabulary searched on the Internet, this article has done certain updates and supplements, and removes stop words from the files after word segmentation.

### 3.3. Data analysis

#### (1) Word frequency analysis

With the help of the frequency of words appearing in the review data, the main product features that users pay attention to can be intuitively obtained. The word frequency statistics of the three products can be obtained through the word frequency statistical analysis. It demonstrates that the user's proposal for the Xiaomi Mi 9 mobile phone is highly concentrated on the screen aspect, while the proposal for the Xiaomi Mi 10 content is concentrated on the MIUI operating system and the screen.

#### (2) Keyword analysis

In order to perform further analysis on the keywords, we will calculate the rank of identified keywords based on their frequency data by applying the TF-IDF technique. TF-IDF algorithm is a basic and effective keyword extraction algorithm. If a word or phrase appears very frequently in one article and low in other articles, then it is considered that the word or phrase has a good ability to distinguish categories. The TF-IDF algorithm formula is as follows:

$$tf_{ij} = \frac{n_{ij}}{\sum_k n_{kj}} \quad (1)$$

$$idf_i = \log \frac{|D|}{|j:t_i \in d_j|+1} \quad (2)$$

$$TF - IDF = tf_{ij} * idf_i \quad (3)$$

where  $tf_{ij}$  represents the frequency of word  $i$  in text  $j$ ,  $n_{ij}$  is the frequency of word  $i$  in text  $j$ ,  $\sum_k n_{kj}$  is the number of words in text  $j$ ;  $idf_i$  represents the prevalence of word  $i$  in all texts,  $D$  Represents the total number of texts, and finally selects words with larger numbers as keywords according to the size of TF-IDF.

This paper uses Python to extract the top 10 keywords from Xiaomi 9 and Xiaomi 10 proposal data. The results are shown in Table 2. Among them, for the words with a weight greater than 0.1 in the Mi 9 proposal data, such as words such as screen, black screen, freeze, and camera, it can be seen that users are most concerned about the system functions, processor, screen and camera of the mobile phone, and it's not very sensitive for the battery, but the words about battery also appeared in the table, indicating that the battery factor is still a factor that users is more concerned about. For words with a weight greater than 0.1 in the Mi 10 proposal data, such as MIUI12, freeze, screen, and black screen, it can be seen

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that users are most concerned about the system functions, processors, and screens of the mobile phone, but the camera, Words such as power consumption indicate that cameras and batteries are still factors that users are more concerned about.

**Table 2:** The rank of keywords

Rank	Xiaomi 9		Xiaomi 10	
	1	Rest screen	0.203	MIUI12
2	Lock screen	0.203	stable version	0.151
3	Unlock	0.174	abnormal	0.147
4	Black screen	0.157	Caton	0.141
5	Status Bar	0.145	Lock screen	0.135
6	Caton	0.145	Android	0.125
7	abnormal	0.136	Screen	0.11
8	Screen	0.121	Black screen	0.103
9	desktop	0.113	show	0.101
10	game	0.11	Status Bar	0.096
11	camera	0.101	Horizontal screen	0.094
12	fingerprint	0.098	Unlock	0.094
13	Negative one screen	0.096	camera	0.086
14	optimization	0.094	WeChat	0.083
15	Charge	0.089	Rest screen	0.078
16	Splash screen	0.087	Crash	0.075
17	icon	0.085	Power consumption	0.071
18	show	0.084	desktop	0.07
19	Increase	0.081	video	0.069
20	Function	0.08		0.067

**3.4. Comparative analysis of proposed keywords and actual product innovation**

**3.4.1. Between Xiaomi 9 and updated Xiaomi 10**

Compared with Xiaomi Mi 9, Xiaomi Mi 10 has made improvements and innovations in many aspects. (1) In terms of system, Xiaomi Mi 10 is the MIUI11 system used when it is released, and Mi 9 is the MIUI10 system. In terms of system functions, MIUI11 has the following 5 functions to added MIUI10: ①Added Vientiane information screen, there are dozens of types of information screen display; ②Unread messages can flash like a breathing light; ③Almighty screen projection function; ④Free download of all themes; ⑤The UI interface is optimized to make the interface much sleeker. The improvements in the system functions of Mi 10 closely match the content of the “screen” proposals that users put forward for Mi 9, such as “the Vientiane screen cannot be displayed normally” and



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“optimize the automatic brightness of the screen”. (2) In terms of processors, the processor of Xiaomi Mi 10 compared to Xiaomi Mi 9 has been upgraded from Snapdragon 855 to Snapdragon 865, which has increased the operating speed of the mobile phone to a higher level, fully responding to the feature of "carton" in the improvement proposal words, reflecting the response to most user demands, such as "855 model -20.1.8-camera flashes after time-lapse photography" "855 model development version-dark mode is not turned on, but the App page is in dark mode show". (3) In terms of screen, the refresh rate of Mi 10 has been increased from 60hz of Mi 9 to 90hz, and the display effect has been better. This can not only be derived from the above analysis of characteristics, but also can be seen from the user's actual proposal data that the Xiaomi community has contributed to the iterative innovation of Xiaomi mobile phones. This article filters based on the captured data, hides unprocessed and to-be-discussed data, and leaves optimized, project-approved, replied, and developing data, such as “dropped frames” and data such as "The splash screen is particularly powerful when the screen is on and when the screen is on" have provided support for the iterative update of Xiaomi mobile phones to a certain extent.

#### **3.4.2. Between Xiaomi 10 and updated Xiaomi 11**

Compared with Xiaomi Mi 10, Mi 11 has also made many technical improvements.

(1) In terms of systems, the factory system of Xiaomi Mi 11 is MIUI12, and the factory system of Xiaomi Mi 10 is MIUI11. Compared with MIUI11, MIUI12 has created the following functions:

- (a) Added a brand-new camera interface and full-screen shooting mode, supporting camera functions such as first-screen function customization;
- (b) Negative one-screen head background area, the head management function has been added, and the status bar has been substantially split. If you slide down from the left and right sides of the screen, there will be different feedbacks. The notification message is opened under the left screen, and the control center is opened when the right screen slides down.
- (c) Make full use of the power-saving features of the OLED screen, to ensure that the mobile phone can display enough content information when the screen is on. Judging from the feature words of the improvement plan proposed by the user, the high-frequency terms in the user proposal such as "camera icon abnormal/not displayed/whiteboard", "multitasking background interface-unable to slide up to close the application problem" and Xiaomi 11 made the actual improvements are highly consistent.

(2) In terms of processors, Xiaomi Mi 11 uses the Snapdragon 888 processor, while the Xiaomi Mi 10's processor is the Snapdragon 865. On the processor, Xiaomi Mi 11 has been

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greatly improved, this improvement highly caters to the high-frequency feature words of "stuck" and "flashback" in user proposals, as well as specific proposal content such as "interrupted when exporting and playing after the automatic editing of MI clips", "stuck/dropped frames when opening the APP", etc. It can be seen that the improvement and innovation of Mi 11 to Mi 10 and the improvement proposals put forward by users also have an obvious direct correspondence.

Through the above-mentioned comparative analysis, we found that for the three iterative mobile phone products of Xiaomi Mi 9, 10 and 11 launched by Xiaomi, each new product has the same function improvement as the improvement proposal made by users in the Xiaomi community for the previous generation product. The high degree of correspondence means that the user's proposal in the Xiaomi community has played an obvious guiding and supporting role in the iterative innovation of Xiaomi mobile phones in terms of product performance.

## **4. Conclusions and recommendations**

### **4.1. Conclusion**

Crowdsourcing innovation is a mode of realizing knowledge that connects enterprises and users. Build a virtual community through the platform, collect product innovation materials and basic data by inspiring actual users to propose proposals for product issues and improvements, and ultimately help product functional improvements and continuous innovation. Xiaomi adheres to the development concept of user participation in innovation. Its online open innovation community, Xiaomi Community, has not only a long operating time but also a high level of user activity, which is very representative in the industry. Xiaomi mobile phone as the company's most important product, its value co-creation activities have been fully reflected in the Xiaomi community. Xiaomi mobile phones have undergone more than ten generations of improvements, and each generation of innovation is based on the needs of users. In the process of collecting user demand information, the Xiaomi community has played the function of crowdsourcing innovations, not only bringing together a large number of "rice fans" to reflect product usage existing problems and defects in the process, and the massive datas collected for the function positioning and specific technical parameters of next-generation product development. Based on the word frequency statistics and cluster analysis of the user's suggestion data, it can provide directional guidance for the iterative innovation of Xiaomi mobile phones and provide ideas for the company's product innovation.

This article takes the 9th, 10th and 11th generation products of Xiaomi mobile phones as the research object, collects all user proposal data of these 3rd generation products in the Xiaomi community, and carries out word frequency statistics and keywords analysis, and then completes the actual product improvement with the 3rd generation mobile phones

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( functional parameters) were compared and analyzed to explore whether user suggestions played a direct supporting role in the product innovation of Xiaomi mobile phones. The results show that the keywords derived from word frequency statistics are fully reflected in the iterative innovation of mobile phone products. Specifically, users' proposals and suggestions for Xiaomi 9 mobile phones are fully reflected in Xiaomi 10 mobile phones. Among the function parameters, it supports the product improvements made by Xiaomi Mi 10; Similarly, the proposals and suggestions made by users for Xiaomi Mi 10 mobile phones are also fully reflected in the latest function parameters of Xiaomi Mi 11, that is, it supports Xiaomi Mi 11. Product innovation made. The above statistical analysis results mean that the suggestions and proposal content of Xiaomi community users have indeed played a direct supporting role in the iterative innovation of the product functions of Xiaomi mobile phones.

#### **4.2. Suggestions**

##### **(1) Set up a diversified reward mechanism**

The active participation of users is an important condition for the maintenance of the crowdsourcing innovation community, and it is also the core driving force for the open innovation community to provide continuous support for enterprise product innovation. The reward mechanism can not only drive the participation of non-Xiaomi community users, but also help motivate users to actively participate in the innovation of Xiaomi products or services, and improve the quality of suggestions or suggestions. Therefore, the Xiaomi community can provide support for the active participation of users and the realization of knowledge, and set up rewards in different forms and contents to improve users' knowledge contribution and sharing behavior, and help the continuous improvement and innovation of Xiaomi products and services.

##### **(2) Improve the quality of interaction between enterprises and users**

The user's comments reflect the user's suggestions for improvement or creative offers for the product or service. Enterprises should increase the positive interaction between relevant staff and users, especially professional engineers. The company's response to user reviews can not only show the company's attention and thinking about user reviews, and express the company's respect and attention to knowledge contributors, but also timely response and interaction can also help strengthen the in-depth contact and relationship between the company and users. Communication, stimulate the enthusiasm of users, promote users to participate more deeply in the knowledge contribution activities of product or service innovation, and bring a greater source of external innovation for the enterprise.

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**(3) Increase professional topic discussion function**

For the topics that most users are concerned about, independent discussion areas or functional modules can be set up to improve the pertinence of user participation and professional sense of belonging, so that the improvement and innovation of products or services can be discussed in depth. By regularly or irregularly launching specific topics, users can engage in topic-oriented in-depth interactive discussions with professionals, which is more helpful to stimulate users' knowledge reserves, and improve the level of product innovation.

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